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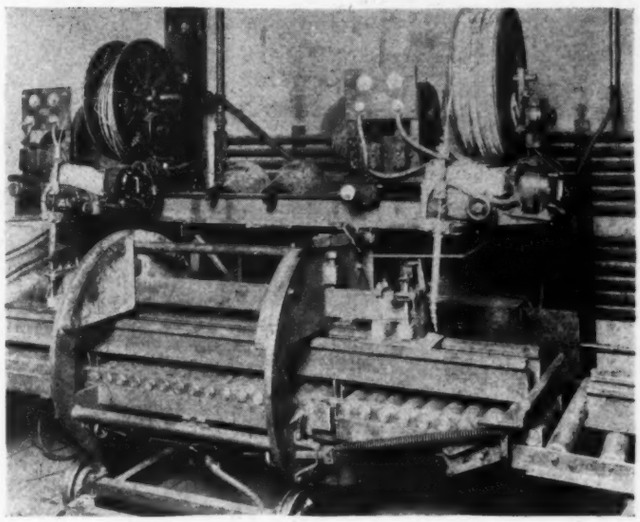

Automatic arc welding of metal railroad ties constructed from scrap rails—

General Electric Company

SEPTEMBER 6, 1930

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ELECTRICAL WORLD

for the Week Ending

September 6, 1930

Federal Trade records saved from flames

Muscle Shoals vitalized by drought need

Utilities all dead-wrong is Roosevelt's plea

Electrical Guild organized to bring contractors peace

—GOVERNOR ROOSEVELT continues crusading. Tells citizenry of New York town to fight for municipal distribution rights and attacks Associated Gas & Electric Company for policies in Rochester.

—FEDERAL TRADE building in Washington burns, to peril of official documents. While water-soaked and scattered, investigation papers will probably need no reworking.

—NEW YORK CITY demurs in face of offer to reduce rates by aggregate $5,000,000. Many company exhibits in the case are in, and M. S. Sloan will testify.

—BREAKER ARC filmed by high-speed camera shows phenomena of interruption as related to gas bubble in dielectric.

—MUSCLE SHOALS, long dormant, leaps to full life as Alabama Power Company accepts large blocks of energy to offset water shortage. July output of plant, 58,300,000 kw.-hr.

—LIGHTNING RESEARCH continues to yield valuable records. Engineers obtain data and oscillograph chart of 4,500-kv. surge on Arkansas line.

—ELECTRICAL GUILD, born of contractors' desire for peace in wiring activities, offered as national panacea for the trade. Closed-shop principle is basis.

—RELIABILITY PLUS is the demand of newspaper publishers in specifying electrification of production. Nearly 100 copies per second requires absolute dependability of energy supply.

NEWS OF THE WEEK

Governor Roosevelt Expresses Freely His Views on Utility Matters

ON TWO occasions in the last week Governor Roosevelt of New York has expressed views on matters connected with the supply of electric light and power which have had wide circulation in the press of the state and have tended to deepen the impression that the Governor sees a widespread controversy impending over the questions of regulation of utilities, mergers and public versus private plants and desires to leave no doubt as to the side on which he will be aligned.

The Governor met the members of his newly appointed St. Lawrence River Power Commission on August 30 at Alexandria Bay, from which point he accompanied them on a tour through the region of the Long Sault, proposed site of a state dam. The party also viewed the site for a proposed power development near Massena.

In the course of this trip the Governor told the village officials of Gouverneur, where a small municipal-purpose plant on the Oswegatchie River is said to sell its surplus of 50,000 kw.-hr. a month to a private utility company at 1¾ mills a kilowatt-hour, the utility retailing the energy to the townspeople at 9 cents, that under his interpretation of the law they would have an excellent chance of obtaining the right to sell the surplus power direct to home owners if they made application to the Public Service Commission for such authority. The Governor had praised the municipal plant at Watertown highly in the course of a stop-over at that city.

To these expressions of the Governor F. L. Carlisle, chairman of the board of the Niagara-Hudson Power Corporation, responded by a letter to the Mayor of Gouverneur in which he pointed out that for the village to enter the business of selling energy to its citizens would "increase its bonded debt and quite probably its taxes." Mr. Carlisle added in part:

If your village board considers acting upon the Governor's suggestion, will you kindly give me the opportunity of attending the meeting, which I hope will be public and to which all the citizens of Gouverneur will be invited, so that all the facts and the whole truth will be made available to the people. If you hold such a meeting, I wish you would invite the Governor to attend, so that the citizens may hear all sides of the discussion, which is not political but solely economic.

Governor attacks mergers

Returning from the St. Lawrence trip, the Governor spoke on Tuesday evening at Rochester. Here he indulged in an attack on utility mergers and went so far as to single out for especial criticism the Associated Gas & Electric Company, which controls the Rochester Gas & Electric Corporation, asserting that the holding company had made itself conspicuous by a refusal to co-operate at Rochester with the Public Service Commission or to open its books. The Governor continued:

Now, this is not a political question. It is a social and governmental problem. I am sure that there are large numbers of enrolled Republicans who have a sneaking sympathy with my attitude on public utilities. This fight is going to go on, regardless of politics.

Nobody wants to put a public utility company out of business or hurt a single investor. But the people of this state have reached the end of their rope as to how far they can let the companies go in the old-fashioned process of watering stock. I would like to know how far we can let these big mergers go when in some instances they take over a company worth

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CITY OF SEATTLE DEDICATES DIABLO DAM

—*Wide World Photos.*

Here is a view in its completed state of Seattle's new Diablo Dam, which was shown in process of construction (with descriptive details) on April 12, page 725. The turbines are not yet in place, but the municipality is rejoicing over the completion of the dam, which has just been formally dedicated.

$200,000 and then write it down on their books as costing $1,000,000 and issue stock for it. The consumer has to pay for it. Of course, we are ready to pay the interest on legitimate investment, but $800,000 of that is pure water.

Nobody is going to be hurt. I repeat that this is a social and a governmental problem, and it is going to be solved regardless of politics. There are going to be saved to the home owners of this state millions of dollars in every section.

In response to an inquiry from the ELECTRICAL WORLD, Associated Gas & Electric representatives said that the company would not at this time make a rejoinder to the Governor's attack.

Herman Russell, president of the Rochester Gas & Electric Corporation, said at that city: "I do not believe Governor Roosevelt is familiar with what to Rochester is very concrete evidence. The electric rates in this city are constantly being reduced, and an effort is continually being made looking toward a downward revision. The rate has been reduced twice in the past two years. For the type of service we give, I do not believe our rates are excessive. We earn approximately 8 per cent on our investment, which certainly cannot be considered too high."

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Associated G. & E. and Clarion River Power

IN CONNECTION with the recommendation of William V. King, chief accountant of the Federal Power Commission, that the costs of promoting and building the Clarion River Power Company's hydro-electric development in Pennsylvania be cut from $11,032,000 (the company's figure) to $4,645,000 (ELECTRICAL WORLD, August 30, page 375), the Associated Gas & Electric Company points out that the report in question was made prior to the time, in 1925, when the Associated bought the Penn Public System (including the Clarion River company), which was previously controlled by H. D. Walbridge & Company of New York. The Associated company disclaims responsibility for the figures attacked by Mr. King.

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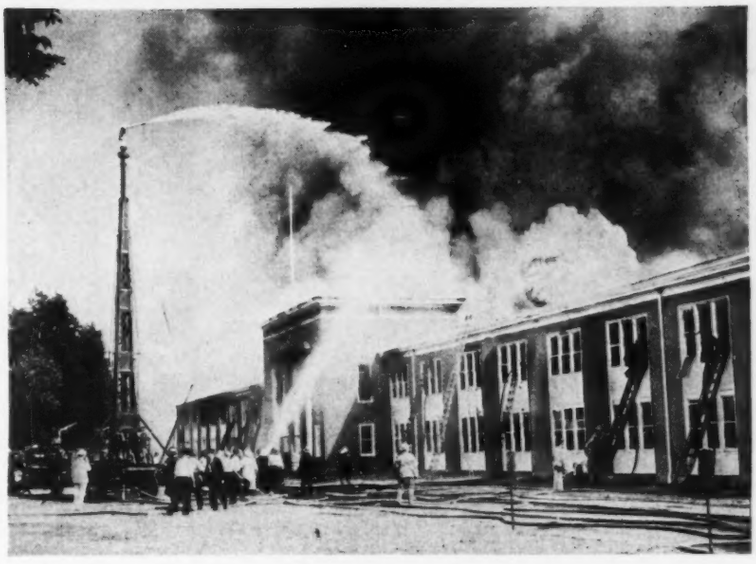
Fight Against Ozarks Plant Still Goes On

LITIGATION to prevent the Union Electric Light & Power Company of St. Louis from obliterating Linn Creek, county town of Camden County, under the reservoir to be built for the company's big hydro plant at Bagnell, on the Osage River, still goes on. A temporary injunction has, however, just been issued in the United States court at Kansas City restraining the prosecuting attorneys and members of the Camden County courts and their attorneys from taking any further action in state courts to stop the construction of the plant.

Counsel for the power company filed suit in the federal court at Kansas City on August 28 to condemn the Camden County court house, in Linn Creek, and about 60 miles of county roads. A hearing on this petition will be held September 25. On August 11 Camden County had obtained an injunction from the County Court restraining the company from instituting the condemnation proceedings.



Fire nearly destroys Trade Commission Building

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Muscle Shoals Output in July, 58,300,000 Kw.-Hr.

ALL of the energy available in the Tennessee River at its present stage is being developed at Wilson Dam. In July 58,302,000 kw.-hr. was produced. Final figures for August are not available at this writing, but the total will be slightly less. Even with the entire flow of the river being utilized, the Alabama Power Company is obtaining only 20 per cent of its requirements from Muscle Shoals. This gives an indication of the extent to which the importance of that development has been exaggerated.

More power was used in July and August than during the entire first six months of the year. From January 1 to June 30 sales of Muscle Shoals power totaled 104,997,900 kw.-hr. In the calendar year of 1929 total sales were 171,681,000 kw.-hr. Maximum production in the history of the operation was in August, 1926, when 65,000,000 kw.-hr. was sold.

Utility Records Little Hurt as Building Burns

SWEPT by a spectacular fire probably started by a cigarette, the Federal Trade Commission Building in Washington was thoroughly gutted last Saturday afternoon, August 30, but few important papers were lost. Although many of the files are water-soaked or have become scattered by hasty removal, it is believed that the public utilities probe, as well as other nation-wide studies, can be resumed without irreplaceable losses after a little delay. Probably it will not be necessary to duplicate much if any of the utility field work. Reorganization is well under way, but no date has been set for the resumption of hearings, though O. B. Johnson, secretary, is quoted as saying that this may be on September 16. Had the blaze not occurred, the commission would have met in the past week.

The commission was in a rambling two-story structure, originally designed in the war period for only a few months' rough-and-ready service. It occupied an entire block. There were no sprinkler systems and no fireproof vaults. Though most spectators of the fire were convinced that the documents were wiped out, most sections came through surprisingly well. Fortunately the docket room, where most of the files are kept, was almost untouched, as was a row occupied by the attorneys and economists engaged in the public utility investigation.

The building will not be entirely rehabilitated, but will be extensively repaired. In the meantime employees will be accommodated in its habitable portion, in another temporary building across the street, or in private office buildings.

New Electrical Body Will Promote Industrial Peace

ORGANIZATION of the Electrical Guild of North America, with headquarters at Washington and with founder members embracing 63 firms engaged in electrical construction in nineteen cities, is announced. Its purpose is thus officially expressed:

The Electrical Guild of North America was organized to promote industrial co-operation in the electrical construction business on a scale hitherto unknown and untried and with sympathetic understanding never before generally practiced in any branch of the building industry It is the Guild's intention to vitalize every department and feature of the industry with a degree of co-operation and harmony hitherto unattempted. It is proposed to make the industry profitable alike to all its members and to the public through survey bureaus, a central research bureau and open understandings with union labor. It is further proposed to make the march of the industry uninterrupted by strikes or other unnecessary, not to say uneconomic, obstacles. Modernization and stabilization of the industry, in short, are the objectives.

These ends will be sought through co-operation with the International Brotherhood of Electrical Workers, whose members will be exclusively employed by the new employers' association in construction work.

The cities so far represented in the membership of the Guild are New York (11 firms), Pittsburgh (9), Cleveland (6), St. Louis (6), Philadelphia (5), Detroit (5), Baltimore (5), Newark (2), Cincinnati (2), Indianapolis (2), Mount Vernon, N. Y. (2), Yonkers, Jersey City, Washington, Boston, Milwaukee, Tulsa, White Plains, N. Y., and Hackensack, N. J. Officers are: President, Louis K. Comstock; first vice-president, John W. Hooley; second vice-president, Chester H. Chapline; secretary, Allan Coggeshall; treasurer, Adolph C. Brueckmann. Annual meetings will be held every April.

▼

Lackawanna Begins Electrified Service

WITH Thomas A. Edison standing at the controls as the train pulled out, regular service on the electrified portion of the Delaware, Lackawanna & Western Railroad was inaugurated on Wednesday, September 3, on the 14-mile line from Hoboken to Montclair, N. J. The first train carried officials and directors of the road and mayors of the New Jersey towns in the electrified area. It left Hoboken at 11.03 a.m. and reached Montclair at 11.22 a.m., beating the best steam-train schedule by six minutes. Two electrified trains a day in non-rush hours as a starting schedule will be added to steadily as operating plans are worked out. (See ELECTRICAL WORLD, July 26, page 148.)

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M. S. Sloan to Testify on New York Edison Policy

TESTIMONY to complete the case of the New York Edison and its associated companies in their petition to the New York Public Service Commission for permission to alter their rate schedules was to have been completed on Friday, September 5, by evidence from President M. S. Sloan covering questions of company policy. Mr. Sloan's testimony was not in time for notice this week.

In previous hearings Vice-President John C. Parker of the Brooklyn Edison Company and Vice-President Franklin H. Nickerson of the Consolidated Gas Company, with which the Brooklyn Edison is merged, testified at some length on earnings and charges. The sessions were enlivened by arguments between William L. Ransom, counsel for the utilities, and Arthur J. W. Hilly, corporation counsel for the city of New York, which is opposing the proposed changes. E. F. Jeffe, an industrial engineer, protested against the coal surcharge retained in the new rates, and Chairman Maltbie ruled that Mr. Nickerson should produce figures concerning past revenue from this source.

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Buffalo General Electric Puts New Unit in Service

AN ADDITION of 75,000 kw. has just been made to Buffalo's electrical supply through the putting into service of the first of three new steam turbo-generators at the Charles R. Huntley station on the Niagara River, north of the city. When the other two machines are put into service the Buffalo steam station will have a total capacity of 466,000 kw. and will be the largest in the entire Niagara-Hudson system. The machine now on the lines, the largest of its particular type yet built, could have supplied the entire electrical needs of Buffalo fourteen years ago. It is fed by two powdered-fuel boilers each of which is capable of converting 3,320,000 gal. of water into steam in an hour. These boilers are of a type developed by the engineers of the Buffalo, Niagara & Eastern Power Corporation and have unusual features.

The new generator is the seventh unit to be placed in the 25-cycle section of

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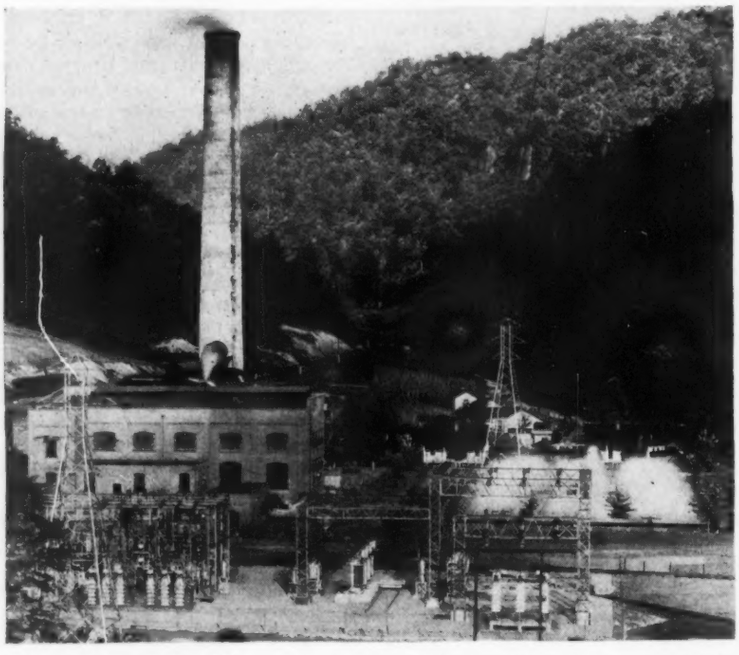
REBUILDING IN THE HILLS OF VIRGINIA



Once more this 30,000-kw. plant of the Old Dominion Power Company at Pocket, Va., is producing energy among the elemental hills. In 1928 a fire wrecked the interior and the reconstruction has not been very long completed. The switching structure is the terminal of a 66-kv. tie with the Pineville (Ky.) generating station of the Kentucky Utilities.

the station. That section now includes 22 boilers with a capacity of 4,560,000 lb. of steam an hour and seven generators with a total capacity of 300,000 kw. In a new section of the station two additional generators of 80,000 kw. each, one of which will soon be ready for service, are under construction. These will both be 60-cycle machines to supply the residential and downtown loads which are now being changed to that frequency. The 25-cycle supply will continue to go to large industrial power and electric furnace users.

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A.I.E.E. at Portland Hears Excellent Papers

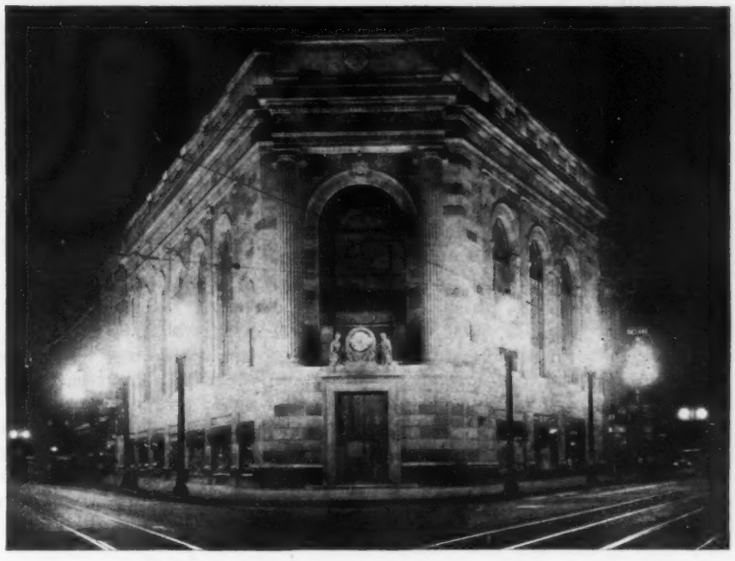
LIGHTNING, transmission, insulation and related problems and apparatus formed the subject matter for several noteworthy papers presented at the Tuesday and Wednesday sessions of the Pacific Coast convention of the American Institute of Electrical Engineers in Portland, Ore., September 2 to 5.

Experimental and field results showing the value of wooden arms on steel towers as a means of increasing impulse flashover values were presented by A. O. Austin. Tests have shown that the effective flashover voltage due to the use of wooden arms is two to three times that where steel is used. H. L. Melvin said that highly insulated lines seem to show better characteristics against everything except direct or branch lightning strokes, and in so far as this is true wooden insulation is of value. However, so little is known about lightning that use of wood thus far, he held, should be considered as an experiment.

A very valuable contribution to the knowledge of three-phase corona loss at 220 kv. was presented by J. S. Carroll, Stanford University. Tests recently completed on a 700-ft. experimental line using various kinds of conductors showed that physical make-up of the conductor, conditions of atmospheric humidity and condition of the conductor surface are the governing factors. The smaller the strands and the more nearly a smooth cylindrical surface, the lower the loss. Scratching of the conductor surface in erection is of no great importance, but weathering or aging of the conductor surface and dirt have a very marked effect upon losses. Tests showed that the loss with a bright new conductor as compared with one that has aged or weathered as little as a week vary as much as ten to one.

President William S. Lee spoke briefly, stressing the importance of close co-ordination in order that the Institute may be of greatest service to its members and pointing out also that decentralization of Institute activities has been of great benefit. Two student sessions and one regular session on Thursday and Friday were to conclude a well-arranged and nicely balanced convention program.

NATIONAL BANK USES NEW-TYPE FLOODLIGHT



A new General Electric combination floodlighting and street lighting unit is used to illuminate the First National Bank Building in Binghamton, N. Y. The units, 21 in number, which appear to the casual observer to be ordinary street-lighting standards, each contain a 1,000-watt lamp in the main fixture and two 200-watt auxiliary lamps. Most of the light is thrown on the building, but a sufficient amount is directed on the street surface.

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Danville (Va.) Council to Submit Another Offer

FOR the third time a proposal to sell the municipal electric and gas plants of Danville, Va., is to be submitted to the voters, who on two occasions in the last four years have rejected smaller bids. This time the figure tentatively accepted by the City Council, subject to a referendum on October 14, is $4,300,000, the bid of the Western Power, Light & Telephone Company of Kansas City.

The Western company's proposal was accepted over that of the Tri-Utilities Corporation of New York, which had offered $4,350,000 for the plants and whose offer had been recommended by engineers after a survey. It was contended, however, that the recommendation was based on an assumed demand for both primary and secondary power, the Tri-Utilities company proposing to build a hydro plant in Patrick County, and that the city would benefit more from the steam-plant development advocated by the rival bidder.

Klamath River Project Licensed—Permit for Bear

LICENSES for three hydro-electric projects in Western states have just been authorized by the Federal Power Commission. The most important is for the proposed development of the California-Oregon Power Company on the Klamath River, Ore., noted last week, which will involve an ultimate installation of 283,000 hp. Construction work on the first unit, costing about $5,000,000, will be started immediately. The other two authorizations related to a 2,400-hp. installation of the Dakota Power Company on Rapid Creek, S. D., and a development of the Pacific Gas & Electric Company on the South Yuba River, Calif. The commission also authorized a preliminary permit for the Pacific Gas & Electric Company's prospective development of 34,000 hp. on Bear River, Calif.

The temporary license held by the Niagara Falls Power Company for diversion of 275 sec.-ft. of water at the Falls was extended for one year. The time for beginning construction under a license held by the Northern Connecticut Power Company for a project on the Connecticut River was extended to February 1, 1932. Crisp County, Ga., was authorized to postpone the completion of its project on Flint River and to operate the portion now constructed.

Many Important Transmission Lines Finished, Building or Planned

PLENTY of activity prevails in all parts of the country in the addition of important transmission lines to existing systems. Some recent news reports follow:

In preparation for starting its new generating station at Ashtabula in October, the Cleveland Electric Illuminating Company is completing a 66-mile, 132-kv. transmission line from Ashtabula to its Northfield substation, where the energy will be stepped down to 33,000 volts and go underground into the East Cleveland substation. The new line parallels from Plymouth to Bedford a line built in 1928 which is also being connected with Ashtabula and Northfield, thus making two complete steel-tower transmission lines between these points. The new line includes a 1,725-ft. span across the Ashtabula River, which is 525 ft. longer than any other span in the entire Cleveland Electric system.

Allied Engineers, Inc., New York, will build the coming transmission line from the Toronto (Ohio) power house and generating station of the Ohio Edison Company to East Akron, where a substation is to be erected. Most of the land for the line, which will be strung on two sets of steel towers, has been acquired and the project calls for 700 towers. The Toronto power station now supplies the Youngstown district, including Youngstown, Salem, Niles and Girard in Ohio and Sharon, Greenville, Mercer and New Castle in Pennsylvania, through the Penn-Ohio system. The plans also involve an addition to the Toronto station.

Permission is sought by the Indianapolis Power & Light Company from the Indiana Public Service Commission to issue securities to the extent of $12,267,000 to construct a 50-mile, 132-kv. transmission loop around the city and to complete construction of its new generating plant on White River. Some property owners in northern Indianapolis are appealing to the commission to refuse to sanction the transmission line on the ground that it would set up destructive and hazardous conditions in the territory.

The Interstate Public Service Company will soon start construction of transmission lines from four sources of energy, all to terminate at Liberty, Ind. This move will relieve the Richmond (Ind.) municipal electric plant of the load taken at the switchboard by the Liberty Light & Power Company, which recently was sold by Robert S. Ashe of Richmond to the Insull interests for a price reported to be in excess of $1,000,000.

A 110-kv. transmission line from Thompson, near Schuylerville, N. Y., to the East Greenbush substation, 4 miles southeast of Albany, is to be undertaken by the New York Power & Light Corporation as part of its present construction program. This line will serve as a direct connection from the company's hydro-electric stations on the upper Hudson and Sacandaga Rivers, including the recently completed Elmer J. West station at Conklingville, to the large power-consuming area surrounding Albany. The line will be 41 miles long and built with galvanized-steel towers 81 ft. high and of special A-frame construction, spaced about 900 ft. apart. A 1,940-ft. span will cross the Hoosick River near Schaghticoke.

The New York State Electric & Gas Corporation has under construction a 32-mile transmission line connecting the Ithaca and Binghamton areas of the company with a 44,000-volt loop line in its Oneonta district. This line, costing in all about $320,000, will cross the northeast corner of the village of Marathon.

Construction of the New Jersey section of the 220-kv. steel-tower transmission line to connect the electric systems of the Public Service Electric & Gas Company and the Philadelphia Electric Company has been completed well ahead of schedule, it was reported last week. The section extends 45 miles from the Roseland switching station of the Public Service to Lambertville, where it will tie in with the section being built by the Philadelphia Electric from Plymouth Meeting, Pa.

The Delta Construction Company, subsidiary of the Cities Service Company, is constructing a high-tension line between Springfield and Sedalia, Mo., to supplement the Cities Service generating plant in Sedalia. The line will cost approximately $350,000.

The Virginia Electric & Power Company has just completed, at a cost of approximately $350,000, a 110-kv. wooden-pole line joining the transmission system of the Carolina Power & Light Company near Littleton, N. C. The work includes a substation addition at Roanoke Rapids.

Another link in the interconnected transmission system by which New Orleans was recently tied in with the Louisiana Power & Light Company's Sterlington station, over 375 miles of line, is under construction. This is a line between Sorrento, La., and Baton Rouge, where the Stone & Webster interests recently completed a 45,000-kw. steam plant for combined special industrial and general utility service. From Baton Rouge the Stone & Webster power lines run west through the southern part of the state to Beaumont, Tex.

The Telluride Power Company of Provo, Utah, is to build a 44,000-volt transmission line from Nephi to Delta in that state, a distance of about 60 miles.

Completion is announced of a high-voltage line built by the Southern Sierras Power Company from San Bernardino, Calif., to the steam plant of the Los Angeles Gas & Electric Corporation at Seal Beach. The expenditure on this line, about $400,000, has been in addition to the 1930 construction budget of the companies associated under the Nevada-California Electric Corporation, which totals $2,000,000.

Coming Meetings

International Association of Electrical Inspectors—Jacksonville, Fla., Sept. 8-11. Western Section, Congress Hotel, Chicago, Sept. 15-18. W. S. Boyd, 175 Jackson Blvd., Chicago. Eastern Section, Pittsfield, Mass., Sept. 22-24. R. Walker, 85 John St., New York.

Maryland Utilities Association—Chesapeake Bay cruise to Jamestown and Yorktown, Va., Sept. 11-13. D. E. Kinnear, 803 Court Square Bldg., Baltimore.

Empire State Gas and Electric Association—Saranac Inn, N. Y., Sept. 18 and 19; Meter Section, Watertown, N. Y., Oct. 9 and 10. C. H. B. Chapin, Grand Central Terminal, New York.

American Welding Society — Congress Hotel, Chicago, Sept. 22-26. M. M. Kelly, 29 West 39th St., New York.

Great Lakes Division, N.E.L.A.— French Lick Springs, Ind., Sept. 25-27. T. C. Polk, 20 North Wacker Drive, Chicago.

American Electrochemical Society — Hotel Statler, Detroit, Sept. 25-27. C. G. Fink, Columbia University, New York.

National Safety Council—Pittsburgh, Sept. 29-Oct. 4. W. H. Cameron, 20 North Wacker Drive, Chicago.

New England Division, N.E.L.A.—New Ocean House, Swampscott, Mass., Sept. 29-Oct. 1. Miss O. A. Bursiel, 20 Providence St., Boston.

Illuminating Engineering Society — Hotel John Marshall, Richmond, Va., Oct. 7-10. E. H. Hobbie, 29 West 39th St., New York.

American Institute of Electrical Engineers—Middle Eastern District, Philadelphia, Oct. 13-15; Southern District, Louisville, Nov. 19-22. F. L. Hutchinson, 33 West 39th St., New York.

Rocky Mountain Division, N.E.L.A.— Franciscan Hotel, Albuquerque, N. M., Oct. 20-22. O. H. Weller, Public Service Co. of Colorado, Denver.

National Electrical Manufacturers' Association — Chamberlain-Vanderbilt Hotel, Old Point Comfort, Va., Oct. 20-24. A. W. Berresford, 420 Lexington Ave., New York.

National Electrical Wholesalers' Association—Pittsburgh, Nov. 10-14. E. Donald Tolles, 165 Broadway, New York.

National Association of Railroad and Utilities Commissioners — Charlotte, N. C., Nov. 12-15. J. B. Walker, 270 Madison Ave., New York.

Overhung Hydro Unit to Be Rated at 56,250 Kva.

FOR the Inland Power & Light Company's coming water-power development at Ariel, on the Lewis River, Washington, the General Electric Company is building at Schenectady what it asserts to be largest overhung-type hydro-electric generator ever made, the generators installed at Niagara Falls and those being built for the Dnieper River in Russia not belonging to that type. The generator for the Ariel plant is a 60-pole, 56,250-kva., 120-r.p.m., three-phase, 60-cycle, 13,800-volt machine, with an over-all diameter of more than 37 ft. and of semi-outdoor construction. The S. Morgan Smith Company will supply the water turbine, which will develop 61,600 hp. at a 185-ft. head and 67,000 hp. at a 189-ft. head.

Simultaneously at the same plant the four smallest overhung hydro-electric generators yet made, rated at 3,300 kva. each, are being manufactured for the Grafton Power Company for installation this fall on the Connecticut River at McIndoes Falls, Vt.

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British Railroads Find Electrification Pays

UNLIKE the four great trunk lines operating in the United Kingdom, the Metropolitan Railway of London enjoyed a still further increase in its gross receipts in the first half of 1930. Judging from the increased receipts of the Metropolitan and London's other big subway system, the Underground Railway, and also from the experience of the Southern with its suburban lines, it would seem that the other railroads might have retained more of their passenger traffic and taken advantage of the increased traveling habit had they begun earlier upon large schemes of electrification in the denser traffic areas.

Quite recently the Southern completed the suburban electrification program it mapped out six years ago. It has cost $63,000,000, and with 800 miles of electrified lines it has now one of the longest electric systems in the world. The improved service has enabled the company to meet successfully the road competition which has grown up. This being mainly a passenger-carrying system, a bold policy was necessary to win the traffic back. All the suburban lines of the Southern have now been electrified, and work is proceeding on the extension to Brighton and Worthing, which will cost $13,000,000.

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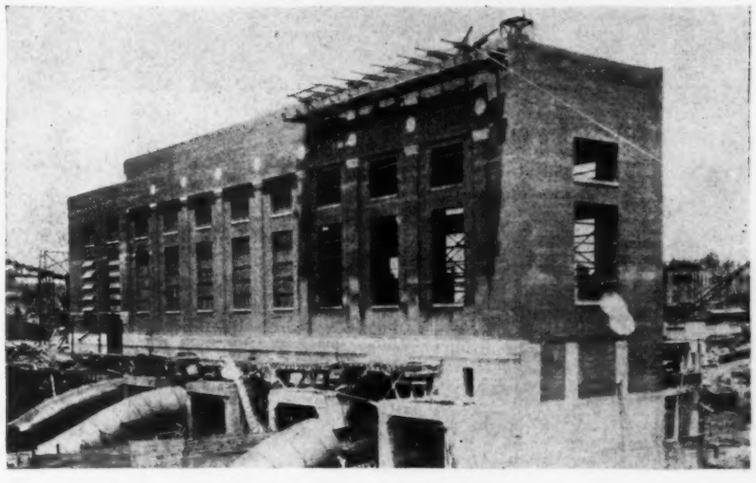
SALUDA RIVER POWER HOUSE AND COMPLETED DAM

ACCORDING to Associated Gas & Electric System officials, the Lexington Water Power Company may be able to begin generating energy on the Saluda River in South Carolina about October 1.

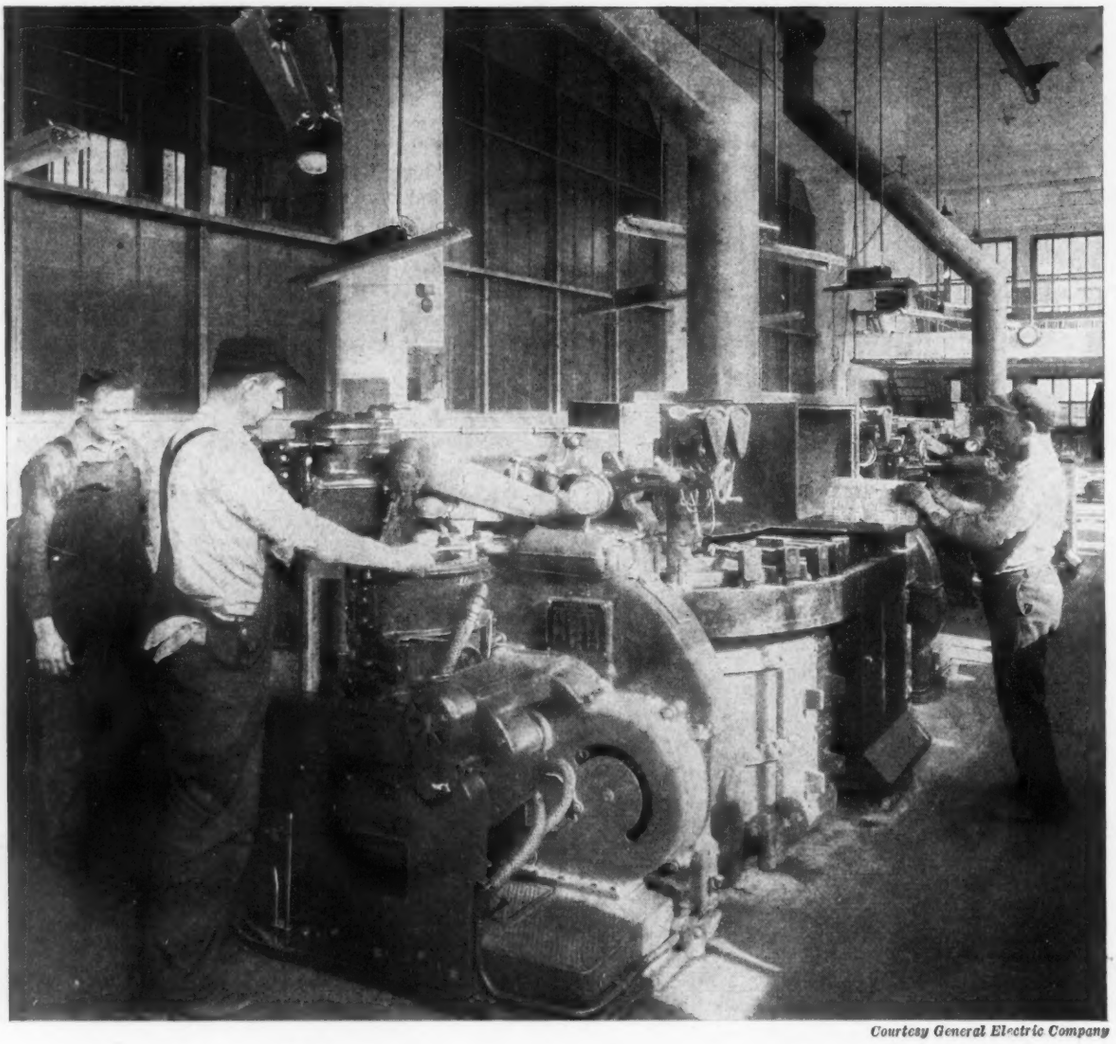
The power station, of concrete, steel and brick, 58 ft. wide, 250 ft. long and 95 ft. high, is ready. Two of the four 55,650-hp. units are virtually completed, work is under way on the third, and the foundation for the fourth has been laid. One of the surge tanks, 206 ft. high and 40 ft. in diameter, has been erected at the rear of the station. Each of the four units will be connected to a steel penstock, 16 ft. in diameter, through the dam to the intake towers. Provisions have been made for the future installation of two additional units.



A 114-kv. substation is expected to be completed in the fall. It is about 800 ft. east of the control room in the power house. The spillway proper has four Tainter gates. They are 25 ft. high and 37½ ft. wide, giving a clear opening of 150 ft. The spillway has a capacity of 50,000 sec.-ft. when the lake is at elevation 360. A concrete highway bridge passes over the spillway. The great earth dam itself has been completed and the top has been leveled, but it will probably be allowed to settle for several years before it will be hard-surfaced.

Work on the Saluda Dam was started in September, 1927.

ALL-ELECTRIC STEREOTYPING



Courtesy General Electric Company

NEWSPAPER stereotype rooms must be organized for production standards of unremitting exactitude. In building the new plant of the New York *Daily News* all-electric furnaces and casting machines were used. Each furnace is equipped with 36 10-kw., 208-volt cast-in heating units. The capacity is 480 65-lb. plates an hour for each.

Automatic control, consisting of panels, push-button stations, general and individual unit overload protection and temperature-regulating instruments, makes uniformity of output certain and unvarying.

EDITORIALS

L.W.W.MORROW
Editor

Drought in South Shows Value of Steam Reserve

RECENTLY recurring conditions of drought in the Southeast again emphasize the need for ample steam-plant reserves for even the most favorably situated hydro systems. These conditions also show that rainfall and stream-flow records must be interpreted with great care and indicate that full consideration must be given to the extent to which ground-water reserves are maintained or depleted according to the manner in which the precipitation occurs. The existing low water after the dry-weather disaster of five years ago further shows that it is unsafe to conclude that such great extremes will not follow one another closely simply because the available records show they never have done so.

The great 1925 drought in the Southeast reduced streams to new low records. Conditions were not better at times for the next two years. In some cases they were actually worse. Then in 1928 and 1929 there occurred excessive floods of short duration, with appearances of a great surplus of water. Early this year most of the storage reservoirs in that part of the country also filled quickly. Serious rainfall deficiencies since then have caused the stream flows to drop much faster than usual. In fact, many streams are near their lowest known stages. Various storage reservoirs also are below normal for this time of the year.

Accurate determination of what has caused so quick a drop after the great excesses of rainfall last fall would require extensive studies over a wide area. It appears, however, that the ground-water reserves, which were much depleted by the three years of deficient precipitation, have not since been fully restored.

Hence it appears that total annual rainfall and stream-flow records need most careful translation. The relatively short time covered by them leaves much to be desired as a guide toward what to expect. In any event such totals are not to be taken at their face value. Nor is the occurrence of a series of dry years any assurance that great deficiencies will not occur again soon. In the last analysis, ample steam-plant reserves offer the only safe insurance of uninterrupted service.

San Francisco Rejects Power Bond Issues

CITIZENS of San Francisco decisively defeated bond issues aggregating $68,115,000 last week. The natural conservatism of the voters in a period of business slump, the purpose of the issues and an active opposition campaign by civic business interests brought about the defeat.

These bond issues were to permit the city to acquire the distribution systems in San Francisco of the Pacific Gas & Electric Company and the Great Western Power Company as part of the municipal power enterprise founded on the Hetch-Hetchy developments. A favorable vote would have been followed by litigation, the Pacific Gas & Electric Company having served notice some time ago that it would ask for a writ of review from the State Supreme Court if condemnation proceedings were started by the city after a favorable vote on the bonds.

Bond issues are not accepted readily by citizens these days. There has been too much spending, taxes are high and times are bad. Selfish interest persuades voters to negative even bond issues for worthy projects. Thus the San Francisco vote was based largely on cold facts rather than upon schools of opinion as to the merits of private or municipal ownership of utilities. And when all is

said the decision for or against such proposals should be based upon economic facts. If this is done, utilities need never fear the decisions.

Employee and Employer Problems

PERSONNEL problems are giving numerous executives many serious hours in this transition period in the electrical industry's development. Readjustments of corporate organization necessitated by mergers are bringing about staff and line changes on many properties, and on others fluctuations in the volume of business are causing company leaders to. study the best ways to fit man and woman power into the shifting picture. These economic movements are often accompanied by difficulties of individual application which result in the severance of ties formed by years of service, and at present a good deal of thought is being given to the making of new connections and to the allocation of competent employees to new or different tasks within the old organizations or the new groupings of properties concerned. It is important to personnel and to the industry itself that new alignments shall be made on the basis of maximum usefulness, and on this account hasty changes in positions should be avoided.

In companies where changing conditions are testing the fitness of personnel to hold specific posts it is important to visualize opportunities for service in new or different fields before reaching the conclusion that ties must be severed and work sought elsewhere. Rein needs to be given to the imagination in these delicate relationships, and friendly conferences and adjustments should be encouraged. On the part of the executive it should not be assumed that the mere contraction of an organization or a transfer of duties to other persons or locations settles the problem of cutting down costs without impairing the running of the company's affairs. On the other hand, the employee facing or sensing an impending change may well study the needs of the property as he sees them and at least be prepared, when circumstances permit it, to suggest the desirability of other work being undertaken, with perhaps a specific service outlined, before accepting the opportunity to look elsewhere.

If an earnest attempt is made to find out whether the affairs of the company or its group can be bettered by utilizing experienced personnel in new ways, it is safe to say that many severances and other changes made on the assumption that the present basic organization of work suffices will be called off. Valuable services will be utilized in new channels, and the annual losses and burdens due to severance will be decreased.

Originality in Design of Disconnecting Switches

THE disconnecting switch has always been considered as a poor relation of the oil breaker—a necessary evil. And yet the "disconnect" deserves much more attention than it has been getting. Many an accident has been caused by the faulty opening or the faulty operation of these switches. Many hours of designing have been spent in trying to find space for handling the switch stick, and many valuable cubic feet of station capacity have been used for installing and handling disconnects.

The ordinary knife-blade switch with its wooden handle was a very ingenious and original development or invention, because it meant the opening of an electric circuit quite safely. But hardly any added ingenious ideas are on record in this field. When voltages grew higher and it was no longer safe to use the wooden handle, some one thought of making a hole in the blade and using a long portable stick for operating the switch, and this hole and stick are principally responsible for most of the awkward and clumsy switch-structure and outdoor-substation designs in which this country abounds. In the outdoor substation, on high voltages, the portable stick is slowly giving way to the gang-operated switch. Numerous mechanisms have been brought out for the purpose, and reasonably good gang-operated switches are now obtainable and are becoming more and more common in outdoor substations. This contributes to simplicity of design and saves space.

But in the indoor low-tension field the stick still

persists. At the insistent demand of operators, manufacturers have brought out some mechanisms, but nearly all of these are uneconomical or unserviceable for small switches. Manufacturers have on their staffs some excellent designers of mechanism who have fathered splendid automatic machines for many purposes. Why not call these men in and submit the disconnect mechanism problem to them? It should not take them very long to produce something superior to the present designs, which seem to be inadequate and lacking in originality.

The Gentle Art of Killing Co-operation

THERE was a day when electrical men were intensely proud of their ability to work together for the development and promotion of the industry. The younger men, from whom the stirring spirit of enthusiasm must always flow, were ready to tackle anything that promised progress. But they are not so ready now.

A few years ago the most spontaneous, ambitious and constructive project ever attempted co-operatively by electrical men was organized for the development of the electrical market in the service of the American people. An "industry sales conference" was set up to plan a five-year sales program. Power companies, manufacturers, wholesalers, contractors, dealers and local leagues participated. They were represented by carefully selected men, officially appointed by the national associates of each branch of the industry. They were good men, intensely earnest and eager to do a good job. They worked for nearly two years, studied the market, employed expert counsel and developed a plan for a broad, courageous program of market building that offered great promise.

One day this plan was submitted to a larger group, also representing all branches of the organized industry, and the meeting promptly fell into a wrangle for three reasons: (1) Certain combination utility men objected to any national promotion of electric cooking; (2) certain manufacturers objected to one feature of the plan for competitive reasons; (3) power-company men present objected to the utilities contributing to any national promotion fund.

A committee was appointed to revise the plan. A revision was made. Another committee was appointed under power-company leadership to carry the matter forward. But for a year and a half the industry has waited, and electrical men are still wondering whether all this thought and work and enterprise is just to die of strangulation and neglect.

The most important considerations before the power industry today are the improvement of public relations and the building of markets—particularly in the domestic field. Manufacturers, wholesalers, contractors, dealers—all are struggling for more business. There has never been a time when such a program as the industry sales conference proposed has been more needed. But more vital than this has been the effect of the deadly silence that has been killing the confidence of electrical men in the value of industry co-operation.

Better Lighting Wanted on Inside Construction Jobs

FOR outside construction jobs floodlighting has become so widely accepted that it is a bit surprising that interiors still suffer from inferior illumination methods in countless undertakings. Walk past a building in process of erection and note the opportunities for improved lighting which thrust themselves with annoying persistence into the line of vision. Is it not exceptional to find a properly lighted inside construction job in full flower, so to speak? Large lamps bare of shades or reflectors and hanging from nondescript supports punctuate the murky atmosphere, and Old Demon Glare, chief devil of the Court of Bad Lighting, holds full sway. Result: Work slowed down while costly labor picks its way through the job, plus a constant accident hazard which has small excuse for being.

The remedy is simple enough, it would seem. The art of industrial fixture design long since reached a point where units suitable for even temporary use on construction jobs could be picked out of a catalog and bought from the nearest supply house.

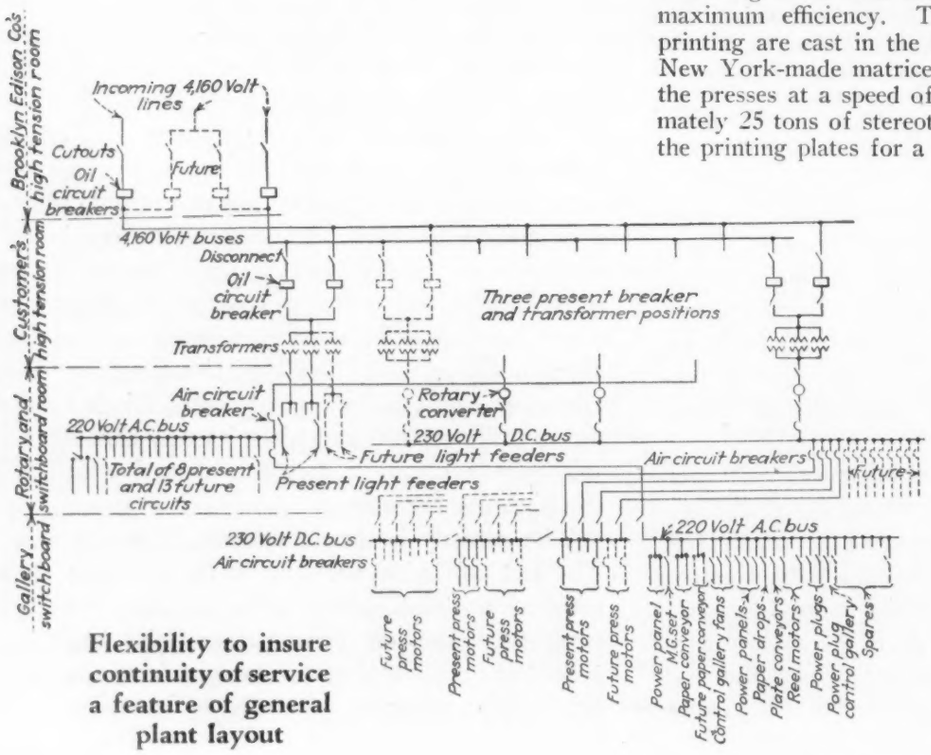
Publishing Demands Split-Second

WHEN newspaper presses are rolling out 340,000 24-page tabloid-size papers per hour, nearly 100 per second, there is no time to lapse into thoughtfulness on the subject of reliable power supply.

This plant uses:
—multiple service from utility
—double high-tension bus
—duplicate circuits
—alternated outlets
—isolated conduit runs
—barriered pull and junction boxes
—time overload relays
—battery reserves for lighting
—direct current for press drives

THERE are few industrial users of electrical energy in large quantities who are as insistent upon virtually perfect service as newspaper publishers. It is almost a matter of reliability at any price. The proprietors of the *Daily News,* New York, are particularly exacting in their requirements. They demand multiple supply to the plant substation, double high-tension bus flexibility, duplicate service and alternated lighting outlets, as well as isolated conduit runs, pull and junction boxes and operating panels which are so provided with barriers that a burn-out will not affect adjacent facilities. A whole series of unlikely failures must be considered as possible, for no major curtailment of output is allowed under any circumstances. Service, wiring and operating facilities are all involved.

The *Daily News* operates on the modern branch production plan. Matrices are made in the New York plant, recently completed in the Grand Central district, and rushed to Brooklyn by small automobile delivery cars. This rapid transportation of relatively light material enables local distribution of papers to the community absorbing them with minimum delivery difficulties and maximum efficiency. The plates used for the actual printing are cast in the foundry in Brooklyn, from the New York-made matrices, and proceed by conveyors to the presses at a speed of 250 ft. per minute. Approximately 25 tons of stereotype metal are required to form the printing plates for a single edition.



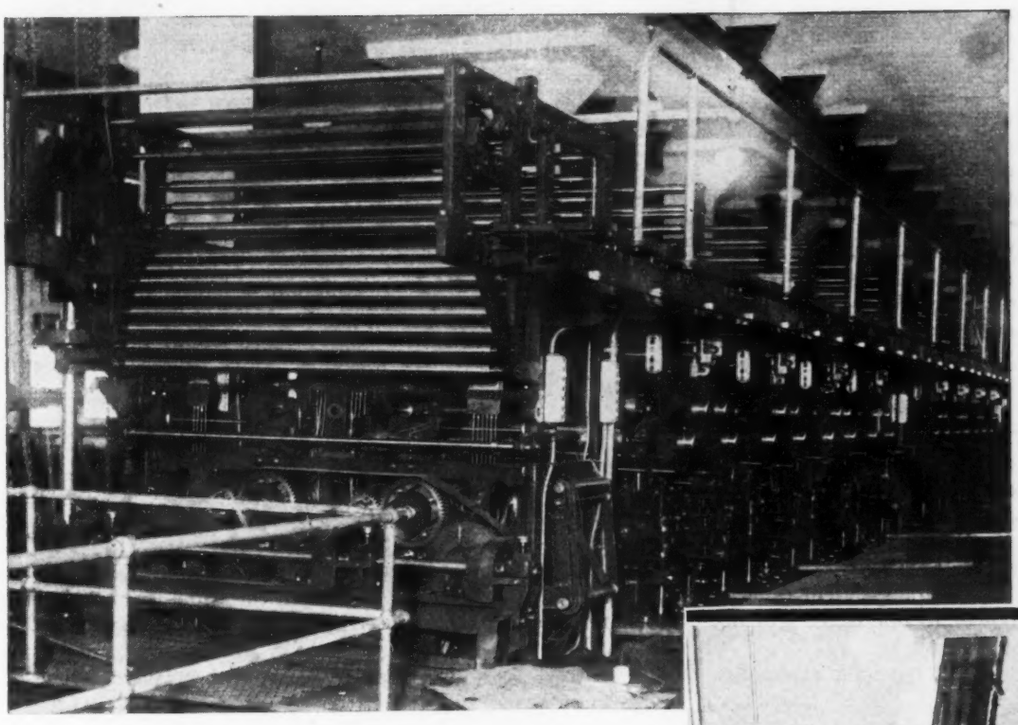
Flexibility to insure continuity of service a feature of general plant layout

Four general features are notable as having dominated the Brooklyn building and its equipment: First, provisions to insure flow of production into channels of greatest economy and speed; second, every safeguard against suspension of production; third, provisions for future growth; fourth, an environment of safety and comfort for employees. Electricity has played the major rôle in every one.

The 4,160-volt lines of the Brooklyn Edison Company, with provision for a third, feed two main buses. The present lines come from different Edison substations. Each feeder to the trans-

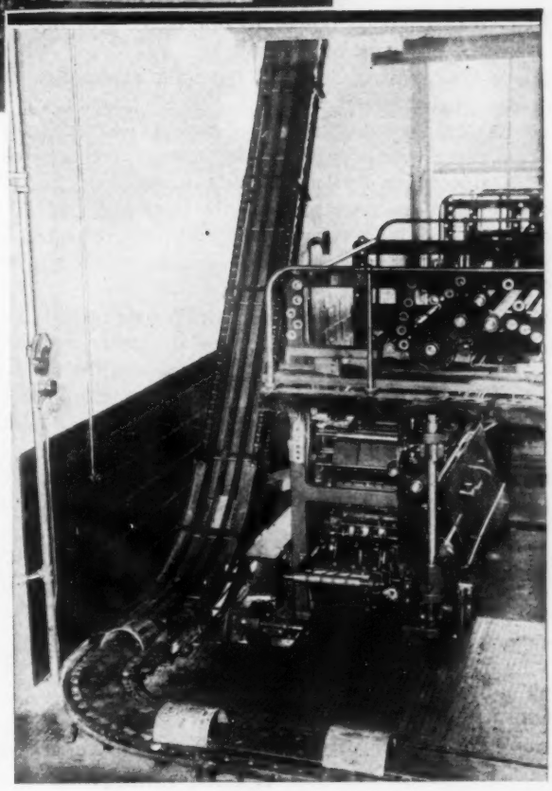
By H. OSBORN
Electrical Engineer
Lockwood, Greene Engineers, Inc.
New York, N. Y.

Service Reliability



Push-button stations completely control newspaper presses

Conveyor carries 25 tons of press plates from stereotype room to presses and back for each edition



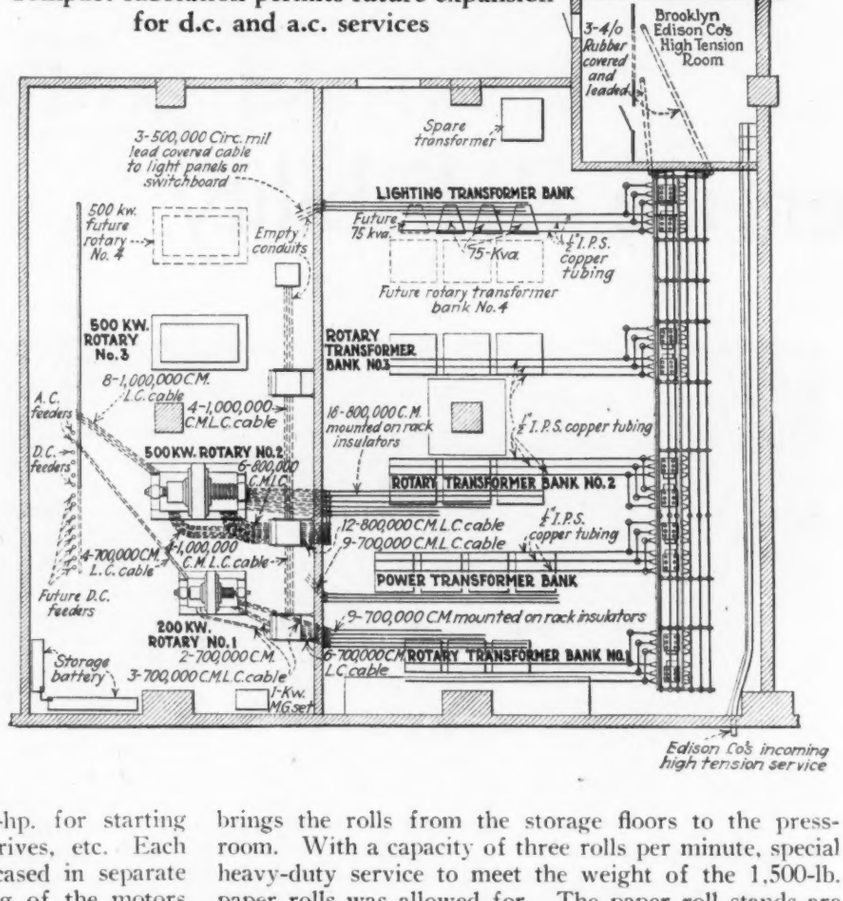
formers is connected to the main buses through two remote-controlled electrically interlocked oil circuit breakers, so that any feeder can be fed from either bus As shown in the single-line diagram for the plant, each of three present transformer banks has its own rotary converter. A fourth position allows for future expansion. Two other banks of transformers feed the 220-volt alternating-current power and light feeders through separate buses. By providing low-tension direct-current buses in the rotary and switchboard room and a bus on the control gallery having sectionalizing switches maximum provision for uninterrupted energy supply is secured for the direct-current press motor drives.

Although alternating-current drives and controls have been developed for the type of presses used, it was decided that they had not had sufficient trial over a long period to warrant their use in this plant. Therefore, at a considerably greater expense, rotary converters and direct-current drives were installed for the presses. Two 500-kw. and one 200-kw. units are now installed. The miscellaneous power load is fed at 220 volts a.c. from a 200-kva. bank. Lighting at 220/110 volts a.c. is supplied from a 225-kva. bank.

A main distribution switchboard, with provisions for increases in capacity, is located in the rotary room in the basement and handles all the energy used. From this switchboard risers carry the power to a secondary switchboard on the control gallery, from which it is led to points of utilization. Remote-control apparatus energized by a 110-volt battery offers the operating facility. In the power substation full safeguards against suspension of service and damage to apparatus have been taken.

Time overload relays protect important circuits. Over-speed equipment is provided on the rotaries. Bell alarms indicate dangerous bearing temperatures. In the case of total failure of the power supply, emergency lights throughout the building will be maintained by storage batteries.

Compact substation permits future expansion for d.c. and a.c. services


3-4/0 Rubber covered and leaded
Brooklyn Edison Co's High Tension Room
Spare transformer
3-500,000 Circ. mil lead covered cable to light panels on switchboard
LIGHTING TRANSFORMER BANK
500 kw. future rotary No. 4
Empty conduits
Future 75 kva.
75-Kva.
½ I.P.S. copper tubing
Future rotary transformer bank No. 4
500 KW. ROTARY No. 3
ROTARY TRANSFORMER BANK NO. 3
8-1,000,000 C.M. L.C. cable
A.C. feeders
4-1,000,000 C.M. L.C. cable
18-800,000 C.M. mounted on rack insulators
½ I.P.S. copper tubing
D.C. feeders
500 KW. ROTARY NO. 2
6-800,000 C.M. L.C.
ROTARY TRANSFORMER BANK NO. 2
12-800,000 C.M. L.C. cable
½ I.P.S. copper tubing
4-700,000 C.M. L.C. cable
4-1,000,000 C.M. L.C. cable
9-700,000 C.M. L.C. cable
POWER TRANSFORMER BANK
Future D.C. feeders
9-700,000 C.M. mounted on rack insulators
200 KW. ROTARY NO. 1
2-700,000 C.M.
6-700,000 C.M. L.C. cable
ROTARY TRANSFORMER BANK NO. 1
Storage battery
3-700,000 C.M. L.C. cable
1-Kw. M.G. set
Edison Co's incoming high tension service

The press control equipment utilized is of the modern Cline-Westinghouse type. Present equipment consists of 30 unit type presses with provision—conduits having been laid and control equipment designed—for 24 additional drives. Direct-current motors operate these machines, 100-hp. motors for normal operation, 7½-hp. for starting and several small motors for roll drives, etc. Each circuit for pressroom equipment is incased in separate galvanized iron conduit and the wiring of the motors is such that each drive has an independent power supply, so that suspension of power to one drive will not affect the operation of any of the others.

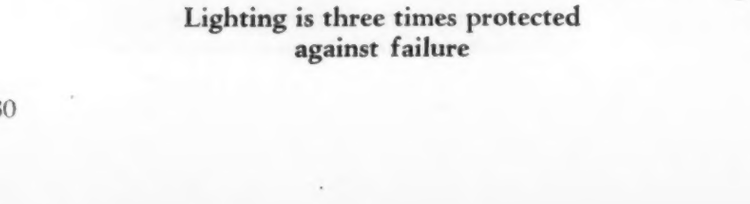
The drives, roll-stands and tension devices are under complete push-button control. These stations are provided at strategic locations on each press unit and in addition there is a master control station on each folder. This master control alone permits starting of the press. The other stations only provide for decreasing speed and stopping. They also operate a safety stop. Lights indicate when any safety button is in and when the press is free to start.

A feature of the installation is the provision for metering power to various departments for cost distribution purposes. Convenient outlets on the columns of the paper storage and pressroom floors permit the use of portable power and lighting equipment.

Rolls of news-print paper are transported from an unloading platform either to storage areas or pressroom by a vertical endless chain elevator. This conveyor also brings the rolls from the storage floors to the pressroom. With a capacity of three rolls per minute, special heavy-duty service to meet the weight of the 1,500-lb. paper rolls was allowed for. The paper roll stands are designed to cut to a minimum the time required to feed new rolls of paper to the presses. The type installed allows the changing of rolls by means of a "flying paster" without stopping the press, improved devices for maintaining electrically the proper tension in the web of the paper being used.

Delivery of papers from the presses is by means of electrically operated paper drop conveyors which bring the copies from the press floor to the shipping floor, directly below. When 100 papers or so per second are being delivered to the shipping department output must be accurately and quickly controlled. A system of Klaxon horns operated from the shipping floor gives the signal to suspend operation of the presses. This may be operated from any one of several stations.

The *Daily News* has recently completed a new home in the uptown district for its main New York plant to replace the older one downtown. Here again has direct-current press operation been selected, but since direct-current supply was available it was possible to eliminate



Lighting is three times protected against failure

Circuits are arranged so that all areas are lighted partly from one riser near one end of the building and partly from another riser near the other end of the building. So in case of failure of one riser, or trouble in one riser shaft, the area will be lighted from the other riser. There are also a few general lights fed from a battery-energized emergency circuit. These are automatically controlled in case of failure of the normal lighting source. In addition to these three lighting sources, there are lights on separate circuits for the presses.

the converting equipment adopted in Brooklyn; however, locations where direct current is and will be available in metropolitan areas are becoming continually fewer. The new main plant of the *Daily News* has adopted one new feature in that the stereotype room is electrically operated, immersion type heaters being used. Each furnace is equipped with thirty-six 10-kw. cast-in stereotype units and each furnace will produce 480 65-lb. plates per hour. This has led to somewhat more uniform results in production of stereotype plates and has improved room working conditions and temperatures appreciably, although a ventilating duct system was installed in the Brooklyn plant with notable success.

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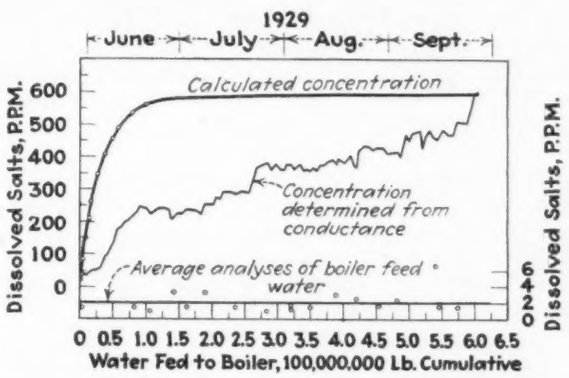
Purity of Feedwater Best Determined by Conductance

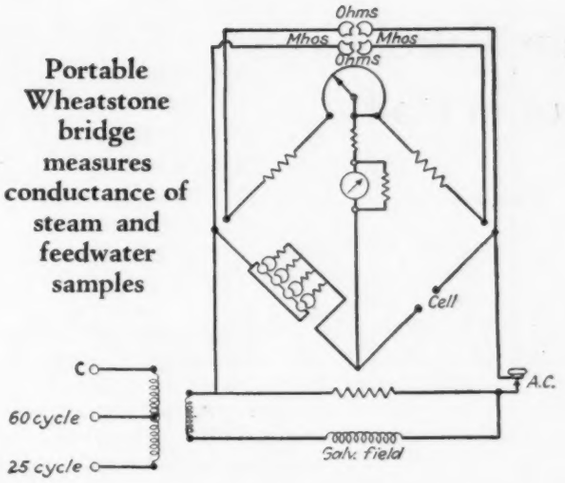
DETERMINING the purity of boiler feed by the electrical conductance method is practically as accurate as the chemical analysis method and is much quicker and more convenient, according to data presented at the recent semi-annual meeting in Detroit of the A.S.M.E. by Max Heicht and D. S. McKinney, chief chemist and chemical engineer, respectively, of the Duquesne Light Company. Simple commercial equipment is used for measuring the conductances and the data are easily obtained and applied to the control of water conditions by the steam plant personnel.



Concentration by conductance less than that by calculation

The conductance method is wide in its scope, being applicable for all purposes where the relation between the "pure" and the contaminating supply is desired, or where the concentration of soluble salts is to be controlled. In the boiler room it may be used for determining the per cent by weight of the entrainment of boiler water in steam, the control of concentration of water in boilers and evaporators, and the detection of carry-over from evaporators.

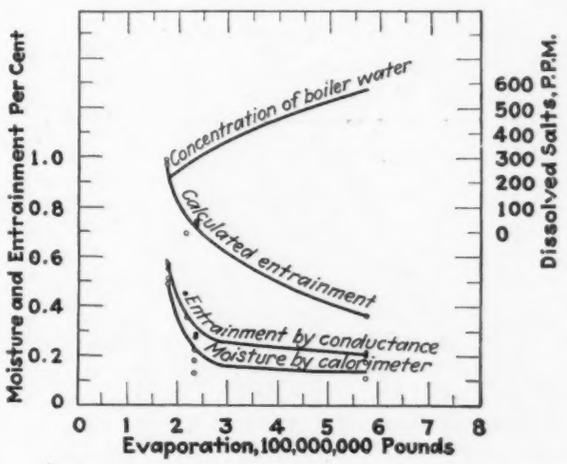
The per cent by weight of entrainment of boiler water in steam may be obtained by measuring the conductance of the steam leaving the drum and of the boiler water coincidentally, dividing the former by the latter and multiplying the quotient by 100. In obtaining the conductances corrections must be made for carbon dioxide.



Portable Wheatstone bridge measures conductance of steam and feedwater samples

In measuring the concentration of boiler and evaporator water, the water is withdrawn through an internally installed perforated pipe. The water is cooled under pressure and passed through a glass flow cell in which the conductance cell is installed. Compensations are made for the temperature observed before each reading. The calibration of the conductance meter is made in terms of the dissolved salts and the calibration, once established, is permanent and is applicable to all boilers in the station unless a major change is made in the quality of feedwater or chemical treatment.

The conductance bridge used to determine the conductivity of the samples of steam and water is a portable mho-ohm Wheatstone bridge operated on either 25- or 60-cycle alternating current. A special and very useful feature incorporated in the bridge is a temperature and cell-constant compensator. The bridge has a range in specific conductance of 0.01 to 0.000001. The slide-wire range is from 1 to 12 mhos, each mho being divided into ten divisions. The temperature compensator covers a range from 41 to 113 deg. F. The standardization point is 77 deg. F. The conductance-cell-constant compensator has a range from 0.07 to 0.11.



Entrainment by conductance closely follows that by calorimeter data

Line Patrol Costs Cut in Half

By B. H. CLARK

Associated Gas & Electric System, Binghamton, N. Y.

THE necessity of regularly patrolling 125 miles of transmission line twice a month led to the adoption of the following plan:

Four lines extended out from the operating center to distances up to 40 miles, and previous practice had been to send regular linemen from that center to do the patrolling. This required cars and drivers to take the men out and bring them in at night. Each inspection of the lines required five linemen and two car drivers for three days, and as two inspections must be made every month, a little pencil work showed that approximately 400 man-hours were used each month for line patrolling.

It was evident that much of this time was spent in riding to and from the day's patrol, so it was decided to use a patrolman who stayed right with the job, instead of coming in at night.

Starting from the operating center, this man walks over about 12 miles of line, and then spends the night at some tourist inn or farmhouse near by. He also secures his meals at that place and next morning is ready to take up his day's patrolling from that point. He telephones the operating office each night in order to report that he is safely in off the patrol and to advise of any line trouble requiring immediate attention.

When the end of a line is reached, bus lines or other means of public transportation are used to return to the starting point, or to another line which is due for inspection.

As equipment, besides the regular field glasses for line inspection, the patrolman carries a small back-pack in which he has a few personal effects, a change of clothes and a small first-aid kit. Incidentally, this first-aid kit includes a supply of anti-venin for treatment of snake-bite, as much of the line runs through country infested with rattlesnakes, and while the patrolman has never been bitten, he kills a number each summer and believes in safety first.

This one-man patrolling cuts the man-hours to about 200 per month and just halves the labor cost. All use of company cars is eliminated and it is no longer necessary to take linemen from their regular work to patrol lines. The company pays the patrolman's expenses while out on the line, but as he is home week-ends, this cost has been found to be very little; in fact, about one-fourth the amount previously charged up to the use of company cars for this work.

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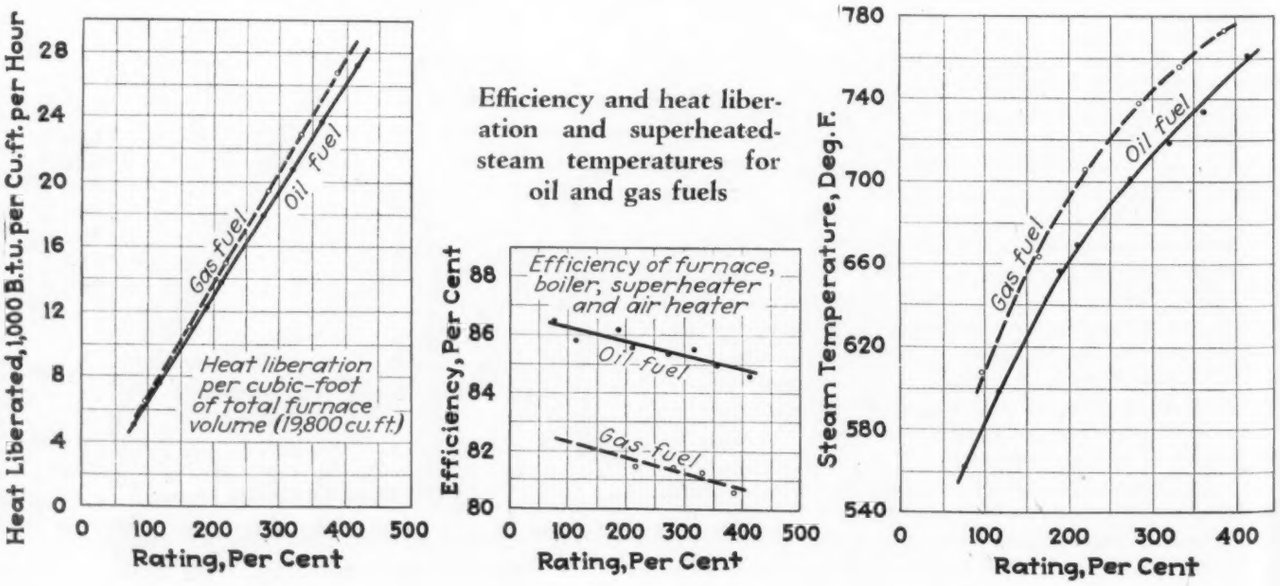
Oil Fuel Proves Efficiency in Comparative Tests

EFFICIENCY with oil fuel was shown to be 4 per cent higher than with natural gas in a series of fourteen tests* on a large boiler at the Long Beach steam station of the Southern California Edison Company. This difference is accounted for by the difference in heat loss caused by combustion of the hydrogen in the two fuels. Superheated-steam temperatures are considerably higher when burning gas fuel. This is caused jointly by the larger flue-gas volume and the lower water-wall heat absorption for the gas. The maximum heat liberation was 27,300 B.t.u. per cubic foot of total surface volume for gas fuel, compared with 26,100 for oil fuel.

The highest rate of output at which the boiler was tested was 450,750 lb. of steam per hour. This represents operation of the 3,416-hp. boiler at 413.2 per cent of rating. In this series of tests trial runs were of four hours' duration at constant steam flow and 15 per cent excess air.

**Abstract of "Comparative Performance of Large Boiler Using Oil and Natural Gas Fuels," a paper presented by F. G. Philo at the convention of the American Society of Mechanical Engineers.*



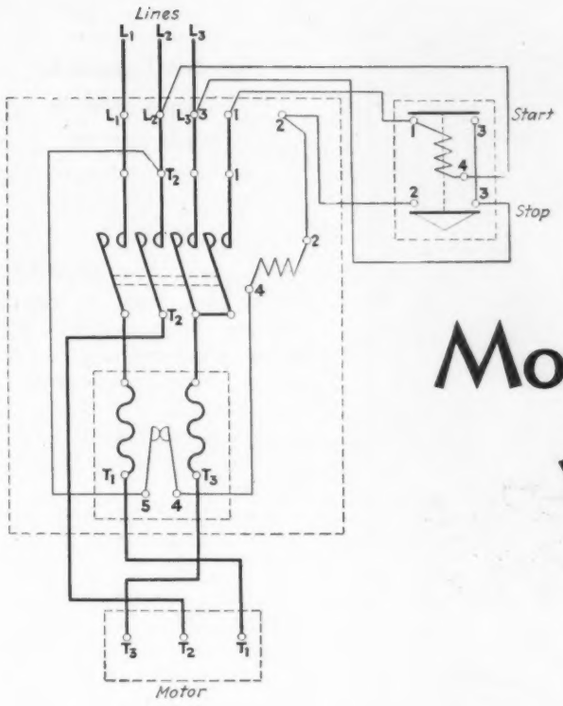


Fig. 1—Delay relay latch for hand compensator

If voltage fails, undervoltage coil releases its plunger, which moves downward to trip latch on running switch. Plunger acts through rack and pinion to accelerate small flywheel. If voltage is restored before latch has tripped, the coil picks up plunger, which is independent of flywheel on return motion.

Motors Need Not Stop When Voltage Dips

Time-delay devices are available to prevent instantaneous undervoltage releases from interrupting production when voltage dips momentarily

By D. W. McLENEGAN

Industrial Engineering Department, General Electric Company, Schenectady

IN MANY plants and in many processes which use electric motor drive serious losses in time and production occur if some of the motors shut down because of momentary reduction or failure of the supply voltage. In most cases the number of these shut-downs can be greatly reduced by the use of time-delay undervoltage releases on the alternating-current motor control panels.

Undervoltage releases are incorporated in practically all motor-starting equipment for the protection of both the operator and the equipment. Until recently most of the undervoltage releases available have been of the instantaneous type. If the supply voltage drops below a certain value such devices will disconnect the motor from the line within a few cycles, or a small fraction of a second, and without regard to the fact that the voltage may be restored almost immediately.

Fortunately most of the voltage dips which occur are of very short duration. They are of the kind which make the lights blink rather than those which leave a home or a factory in total darkness for several seconds. During these very brief disturbances the motor might continue to run with only a small drop in speed, but with an instantaneous undervoltage release the line contactor opens and the motor is shut down. With a time-delay undervoltage release the controlling contactors or switches will not shut the motor down unless the interruption in voltage continues for a time longer than the setting of the time-delay relay. In many cases the time-delay undervoltage relay will permit the motor to ride through the disturbance without giving any indication that a voltage dip has occurred.

Time setting must be a compromise

The choice of the proper time setting for an undervoltage relay depends on two factors. The time setting must be long enough to last through a large percentage of the voltage dips which occur, otherwise the usefulness of the relay will be limited. On the other hand, the time setting must not be long enough to allow the motor to come to a standstill during a failure of voltage. For example, consider a plant having 100 motors, each equipped with a time-delay undervoltage device. If the setting of these devices were long enough to allow all of the motors to come to rest on failure of voltage some might fail to restart because of very heavy loads. All of the motors, being at a standstill, would draw high inrush current when power was restored, and in all probability the voltage would remain below normal until some of the motors were tripped off the line by their overload relays.

Therefore the selection of a proper time setting for a time-delay undervoltage relay involves a compromise between these two considerations. In each case the nature of the load and the driven machine will determine the rate at which the motor slows down upon failure of voltage. A motor driving a crusher, for example, might come to rest in one or two seconds. On the other hand, a flywheel motor-generator set would coast for several seconds without much loss in speed. A time setting of 1½ seconds appears to be a good compromise on which to base the design of time-delay undervoltage relays. Experience has shown that a relay with this time setting is adequate to take care of the great majority of voltage dips and also to protect both the operator and the process.

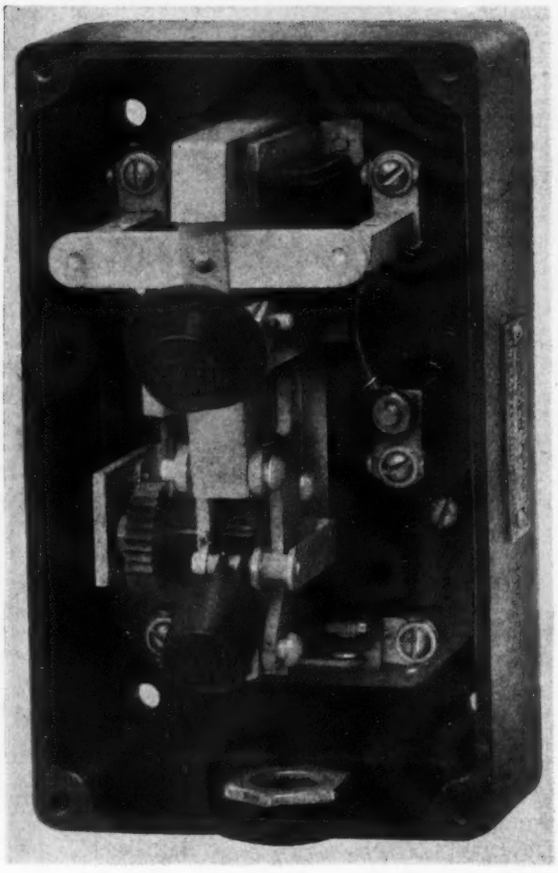


Fig. 2—Time delay incorporated in push button

A time-delay undervoltage relay must be chosen with reference to the type of control equipment with which it is to operate. Manually operated control equipment, such as the familiar hand compensator used with squirrel-cage induction motors, requires that the time-delay undervoltage device shall be in the form of a latch, which holds the running switch closed temporarily after a failure of voltage.

Push-button starters, such as the magnetic switches or magnetic compensators frequently used with squirrel-cage motors, require a different type of time-delay undervoltage device. In control equipment of this type the operating coils of the contactors are usually energized from the alternating-current power supply and consequently the contactors drop open on failure of line voltage. A time-delay push button (Fig. 2) may be used with control equipment of this type. The timing device incorporated in the push button maintains the operating circuit of the panel for a short time after failure of power and enables the contactors to reclose if voltage is restored within the time for which the device is adjusted. Since the time-delay push button has no mechanical connections with the starting equipment, it can be readily applied without modification to a wide variety of magnetic starters.

Very large control equipments involving motor-operated or solenoid-operated oil circuit breakers are usually tripped by energizing a tripping coil. For these equipments the time-delay undervoltage relay will be of the circuit-closing, time-delay type, which is available in many different designs.

Time-delay relays produce best results with squirrel-cage motors because the starting of squirrel-cage motors is inherently simpler than that of any other type of motor. The time-delay latch used with a manual starting compensator simply holds the running switch closed. If voltage is restored soon enough, then the motor is still connected across the line and should accelerate to full speed.

When the time-delay push button is used with a magnetic switch the contactor may drop out on failure of voltage, but will reclose if voltage is restored within the time setting of the relay, and again the motor accelerates on full voltage. When the time-delay push button is used with a reduced voltage magnetic starter the contactors will drop out on failure of voltage. Then if voltage is restored the motor will go through the regular starting sequence, namely, reduced voltage and then full voltage. It must be determined whether the motor will have enough torque to accelerate when it is restarted on reduced voltage. If the torque generated by the motor on reduced voltage is not enough to accelerate the load, connections must be made so that the time-delay push button will cause the running contactor to reclose instead of the starting contactor. The first method would be suitable for a centrifugal pump drive, in which the load falls off rapidly as the speed is reduced. On the other hand, in the case of a ball mill or a reciprocating compressor drive, which require as much torque at low speed as at high speed, it would be necessary to put the motor back on full voltage instead of reduced voltage.

Wound-rotor motors also amenable to time-delay releases

Time-delay undervoltage release can readily be applied to wound-rotor induction motors if the control equipment is of the magnetic type, with contactor control of the secondary resistance. Upon loss of voltage all contactors drop out. If voltage is restored the time-delay push button will restart the motor with the starting resistance in the rotor circuit, insuring adequate motor torque. If the equipment is designed for definite time acceleration resistance will be cut out automatically until the motor develops its maximum torque at standstill. Since this torque is usually between 200 and 300 per cent of full-load torque, it is fairly safe to assume that a wound-rotor induction motor will restart its load after a momentary shutdown.

If the control of the wound rotor is manually operated or if it consists of a drum controller for the secondary circuit and a magnetic switch for the primary a time-delay undervoltage release may be used on the primary control. However, after a voltage dip the motor will have to accelerate, without any external resistance in the rotor circuit, since the controller will remain in the full-speed position. Under this condition the torque developed at standstill will be comparatively low. Hence the time-delay device must have a shorter time setting, since the motor may not pick up if it has dropped below about half speed.

Synchronous motor can be time-delayed

Where synchronous motors are involved the application of time-delay undervoltage devices is not quite as simple as in the case of induction motors and it requires consideration of the characteristics of the motor and its load.

In general, 60-cycle synchronous motors designed for speeds of 514 r.p.m. or above will develop a comparatively high torque when operating as induction motors without d.c. excitation. Generally speaking, motors in this class can carry full load as induction motors without d.c. excitation and run at a speed slightly below synchronous speed for a limited time. If the flywheel effect (WR^2) of the connected load is not excessive they can usually be synchronized while carrying full load. The lower speed motors, from 72 to 400 r.p.m., are generally designed for lower starting and accelerating torque. Unless designed oversize specifically to obtain higher torque, these motors ordinarily develop from 40 to 70 per cent starting and accelerating torque and therefore cannot carry full load while operating out of synchronism or without d.c. excitation. Of course, there are exceptions to these rules. Low-speed synchronous motors for driving ball mills, rubber mills and other drives with heavy starting requirements are designed with starting and pull-in torque of 100 per cent or more, and the use of these high-torque, low-speed motors is increasing. However, the classification of "low-speed, low-torque" and "high-speed, high-torque" is, in the writer's observation, the more usual classification of synchronous motors.

This difference in characteristics requires the use of different methods of applying time-delay undervoltage releases to these two types of motors. Consider, first, the high-torque motor; for example, a 1,200-r.p.m. synchronous motor driving a centrifugal pump. If the voltage fails momentarily, the motor will drop out of step, but if a time-delay undervoltage release is applied the motor will continue to run as an induction motor when voltage is restored, and can then be resynchronized. This type of application, therefore, can be protected by the use of a time-delay undervoltage device on the running breaker, together with relays which will operate to remove excitation when the motor goes out of step and which will again apply excitation when the motor is ready to resynchronize. It a reduced voltage starter is used it may be necessary to arrange the undervoltage relay in connection with the running contactor instead of the starting contactor, depending on the load and the accelerating torque required by the driven machine.

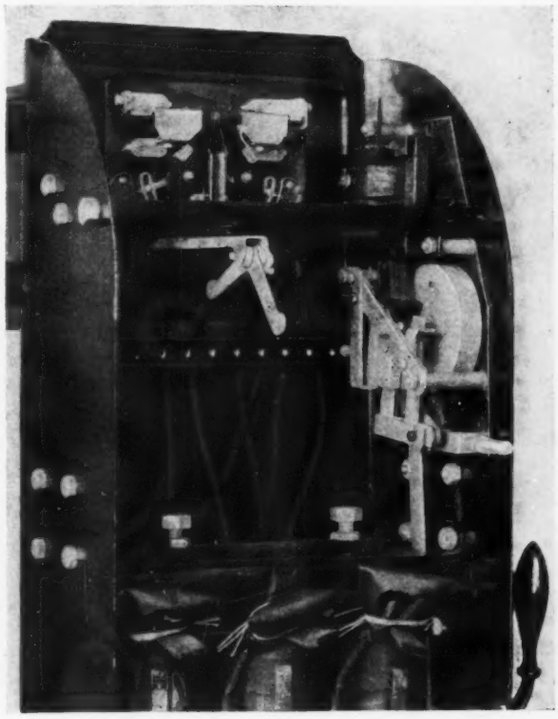


Fig. 3—Compensator including time-delay feature

The low-torque motor problem

The low-speed synchronous motors, having only 40 to 70 per cent pull-in torque, cannot continue to run after dropping out of synchronism unless the load is relieved. However, it has been found that motors will "ride through" the shorter voltage dips without dropping out of synchronism, provided the running breaker is held closed and the field remains energized. Records show that the voltage does not fail completely in all cases, but sometimes drops momentarily to 40 or 50 per cent. At 40 per cent voltage a synchronous motor having 175 per cent pull-out torque will still develop about 65 per cent of full-load torque, and therefore does not drop out of step instantaneously. If the voltage is restored within a fraction of a second, the motor may not have fallen back beyond the pull-out point and will still be in synchronism.

There are hardly enough data to determine the percentage of voltage dips which can thus be avoided on any given power system. However, records have been kept on certain installations as to the number of shutdowns which occurred when using instantaneous undervoltage releases and of the number of shutdowns after the control equipment had been modified to prevent immediate drop-out of the contactors. These records show a surprising reduction in the number of interruptions. They indicate that in these cases many of the voltage dips were of very short duration, such that the motor would actually remain in synchronism if the controlling switches were held closed.

Modifying synchronous motor panels

Manually operated panels for low-torque motors may be equipped with a time-delay undervoltage relay which will hold the running breaker closed. If the field switch is manually operated, it will remain in the operating position

during the voltage dip. If the excitation is controlled by a contactor, the operating coil of the contactor may be energized with direct current to prevent drop-out during momentary failure of line voltage. With push-button control employing a.c. contactors, it is advisable to hold the contactors closed during the voltage dip rather than allow them to open and then automatically reclose upon return of voltage. Where a separate, motor-driven exciter is available, or other d.c. source, the operating coils of the contactors may be energized from this source to avoid immediate drop-out on failure of line voltage. Of course the exciter will also slow down during the voltage dip, but will usually generate adequate voltage for at least as long a time as the synchronous motor can remain in synchronism.

Motor-driven compressors

A great many of the interruptions due to voltage dips occur in connection with low-speed synchronous motors driving air or ammonia compressors, since motors of this type are practically the standard drive for reciprocating compressors.

Some air compressors are arranged to permit the use of magnetic unloading devices which can be controlled from the motor panel. Where these devices are available it is possible to eliminate interruptions due to voltage disturbances almost entirely. For such applications the running switch of the motor panel is equipped with a time-delay undervoltage release. The field-controlling mechanism is arranged to remove excitation when the motor falls out of step and the magnetic unloader of the compressor is actuated so that the compressor will also be unloaded or by-passed. Upon return of voltage the motor can then run without excitation and without load, as it does during starting, and will automatically resynchronize and resume its load.

The case of many small motors

Where a large number of small motors are employed in a manufacturing process the additional cost of time-delay devices may be excessive. For example, the weave shed of a textile plant may contain hundreds of small motors, all of which must operate together. These motors are controlled by small snap switches and a group of motors is protected by an oil circuit breaker. The snap switches are not provided with undervoltage releases, but the circuit breaker may be equipped with a time-delay undervoltage release which will eliminate many interruptions of service and yet protect the operator in case of a prolonged failure of voltage.

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Revenue and Voltage

Improved regulation increases revenues only when accompanied by sales of additional appliances. Practical considerations modify theoretical gains

By MERRILL DE MERIT
Formerly Distribution Manager West Penn Power Company

GOOD service as characterized by voltage regulation depends upon the conditions under which service is given. This is recognized by many public service commissions. Service which is satisfactory to rural customers can frequently be provided where the cost of service with good regulation would be prohibitive.

Unless there is some economic advantage in improving the regulation at any point or unless the customer is dissatisfied with the regulation, there is no valid reason for spending money to correct voltage conditions. In some locations it may be advisable and economical to allow voltage fluctuations and variations three or four times as great as it is in others.

Although all voltage regulation troubles are due to fluctuations of voltage and the real difference is only in the period of fluctuation, these may nevertheless be divided into two classes:

1. Those which may be characterized as flickers.
2. Those which may be characterized as low-voltage troubles.

Generally, no loss of revenue results from the first class of voltage troubles. The service should be improved only if the customer is dissatisfied, which may be because it interferes with the use of some appliance or the flicker is disagreeable to him on account of his previous lighting training.

Low voltage results in loss of revenue, which may be due to the fact that it prevents the customer from using additional appliances or because it reduces the actual consumption of the lamps already installed. It is an economic problem worthy of study.

The improvement of voltage under these conditions will increase revenue, and unless the customer is located in a very scattered section it will frequently be found economical to spend the necessary money to improve the condition. It is difficult to get a measure of the benefit to be derived by improving low voltage. Some valuable and rather extensive experience with such condition indicates that the calculated increases in revenue will not occur.

This experience has been obtained during eight years on a system a large portion of which was formed by an amalgamation of several smaller companies. This part consisted, in the main, of about thirty distribution systems for towns ranging in size from 10,000 to 25,000 inhabitants. All of the distribution systems were tied together by transmission lines. Voltage conditions in general in these towns were bad and there was much deferred maintenance. It was necessary and advisable, and we finally succeeded in obtaining and spending more than $2,000,000 in rehabilitation. The management was

largely composed of men with commercial training and each dollar spent required definite justification in terms of additional revenue or reduced expense.

Engineers were sent out with linemen during October, November and December of each year and checked the load on each transformer, the direction of flow of current, the primary voltage, the secondary voltage at each transformer and the secondary voltage at the end of each secondary. All readings were taken between 6:30 and 9:30. Residential transformers were tested on week nights and commercial section transformers were tested on Saturday nights. Curves of load at the substation of each circuit were plotted, and the transformer loads and the voltage readings were then corrected depending upon the time taken. Substation load curves for the period of three months were obtained and corrections were made in all readings to the time of maximum station load. These correction curves allowed readings to be taken from 6:30 to 9:30 through October, November and December and the correction of these readings to indicate approximately maximum transformer loads and voltage drops. With a normal voltage of 115, voltages as low as 97 frequently existed at the ends of secondaries.

These tests furnished data from which could be calculated the theoretical increase in consumption. Corrections were, of course, necessary for the location of each customer on the secondary, for the lower drop at time other than peak load in the evening and for the much lower voltage drops which occur during the summer months.

Revenue increased appreciably

Since the consumption of lamp varies approximately as the square of the voltage, it might seem that an improvement of 15 per cent in secondary voltage would cause an increase in revenue in the neighborhood of 30 per cent. Actually, after all corrections and computations are made for the entire year, it will be found that theoretically the increased revenue will be more nearly 8 per cent.

After about four towns had been revamped and had passed through 1½ years of operation under the new conditions, a practical check of the increase of revenue resulting from the revamping was made. It was found that this increase in revenue was considerably less than the theoretical. Further investigation indicated that where abnormal increases in bills had occurred as a result of the improvement of voltage, customers had taken steps to reduce their bills by putting in smaller lamps. Theoretical studies were then repeated, with various assumptions of the maximum to which a customer's bill could be boosted by this means. With a maximum individual increase of 10 per cent the theoretical figures checked closely with the increase which took place after the revamping was completed. Later determinations reaffirmed these relationships.

This indicates that, except where the improvement of voltages permits the sale of additional appliances, there will be little difference in the increase in revenue whether the voltage is improved from the 8 per cent average low voltage or from a 15 per cent average low voltage. Generally, the increase in annual revenue was between 3 and 4 per cent. Expressed as a percentage of the cost of the revamping in each case the annual increase in revenue was about 14 per cent. However, this depends upon the grade of construction to which the distribution system is brought in each case and is not generally applicable.

The cost of determining the actual and the theoretical increase in revenue is about equal to the cost of making the engineering design of the revamping and supervising the construction.

The rate of the lowest block on the schedule is generally applicable to the increased consumption, and so increase in kilowatt-hours on a percentage basis may be three times as great as the increase in revenue. Most of the increase in revenue will come in the four winter months. Both facts can be used in segregating the actual increases.

As far as could be determined, no increased consumption resulted from heating appliances. Apparently, with low voltage, heating appliances consume less in any instant, but consume energy more nearly continuously or for a longer period and use about the same number of kilowatt-hours in any case unless the voltage is too low for any operation.

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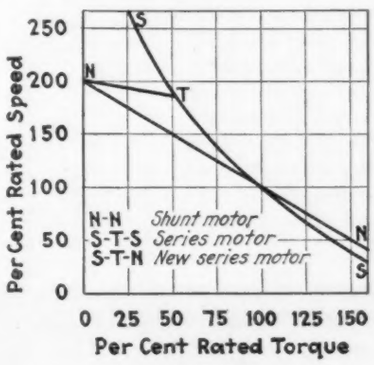
Brake Gives Series Motor Shunt Motor Characteristics

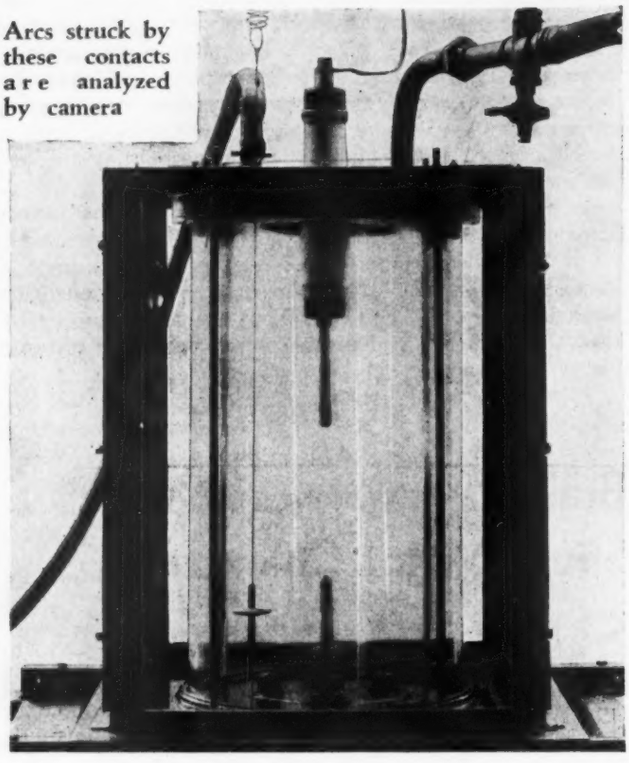
SMALL fractional-horsepower motors for alternating-current operation are usually wound as series motors, because the great phase displacement between field and current precludes a shunt field. The speed-torque curve of such a motor rises asymptotically at no load, causing a dangerous runaway speed when idle. The same holds true for small direct-current or universal type motors. To overcome this difficulty a German designer has developed a miniature centrifugal brake, which finds room in one of the slightly enlarged motor end-shields. Two movable brake blocks are held together with suitably dimensioned helical springs. At about 75 per cent above rated speed centrifugal force overcomes these springs, causing the blocks to chafe against a rim, cast on the end-shield. The result is an effective brake, which prevents the motor from reaching undue speed.



Comparative performance curves for motor with and without brake

The characteristic of such a motor is quite similar to a shunt motor, as indicated in the accompanying figure. If used on a direct-current motor it becomes possible to build the motor as a series motor, thereby avoiding the expensive and not fully reliable shunt-field winding without sacrificing an easy start and a good pull-out. A detailed description of the design may be found in the May 1, 1930, issue of the *Elektrotechnische Zeitschrift*.

Filming the Breaker Arc



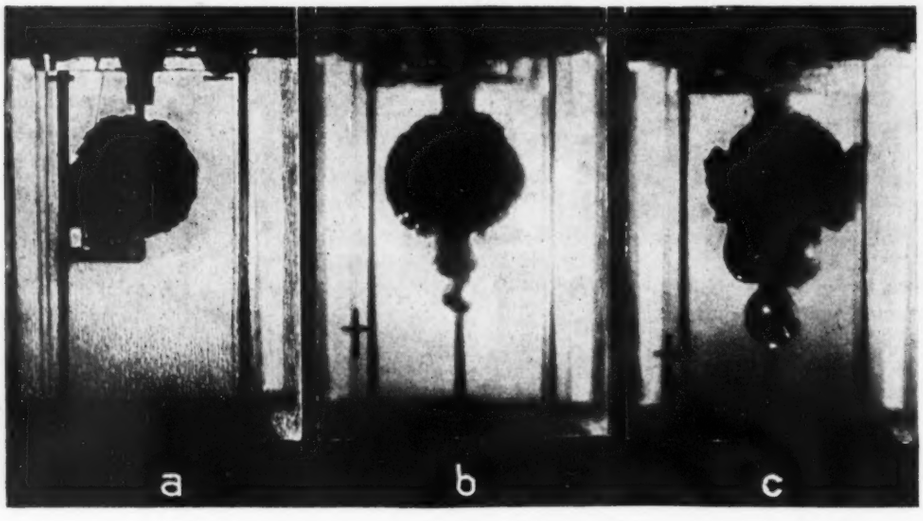
Arcs struck by these contacts are analyzed by camera

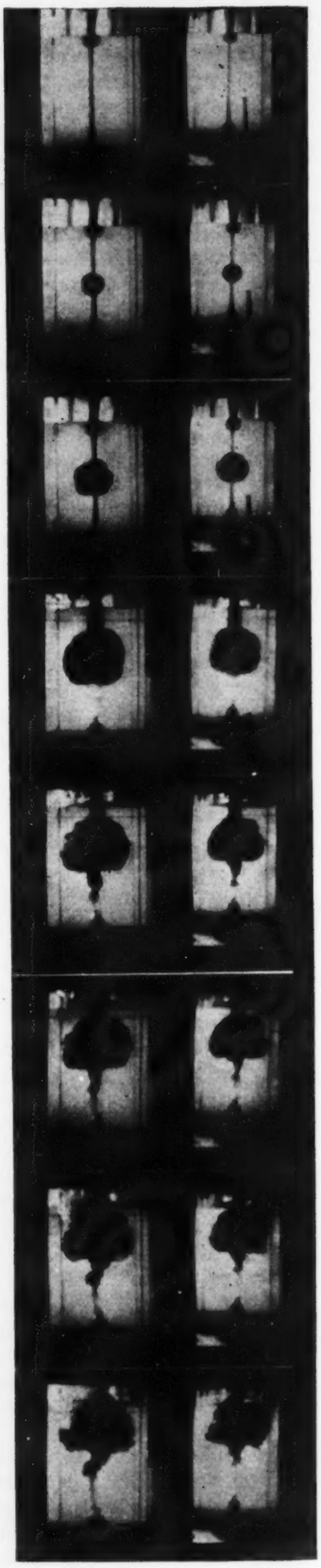
FORMATION and breaking under oil of a 24,000-kva. arc at 8,000 volts have been successfully photographed in slow-motion pictures by Brown Boveri & Company, Switzerland. The film was exhibited recently at a meeting of the apparatus committee of the New England Division, N.E.L.A., by the Condit Electrical Manufacturing Company, American associate of the Brown Boveri Company. The photographs reproduced here show clearly the spherical gas bubble growing to its largest diameter, and then rising to displace the oil piston above it as the contacts continue to open.

Filming of the arc incident to circuit interruption was made possible by the use of an oil circuit breaker having a very strong cylindrical glass tank. The upper terminal shown in the illustration is stationary, the lower being moved downward on interruption. The camera was arranged to obtain simultaneously a direct and a 90-deg. view of the arc, using a mirror placed to one side of the tank; 200,000-cp. arc lamps were necessary to give proper illumination.

Three successive stages in arc formation

(a) Large gas bubble forms immediately
(b) Gas bubble expands, remaining stationary in oil
(c) Bubble moves upward, displacing oil piston





Portion of slow-motion film showing formation of gas bubble and oil piston

Business Recovery Under Way

Utility executives believe a slow recovery is in process. Nearly all sections report a slight revival

Slight upward trend apparent in most sections

[A] Pulp industry is improving Woolen industry still depressed. Savings accounts static. Vacationists not spending.

[B] Doubtful if depression has spent itself. No definite industrial recovery. Money plentiful.

[C] Shipbuilding and oil refining more active. No positive sign of upward turn generally. Incoming crops stimulating trade. Building slightly more active.

[D] Woodworking and building supplies more active. Crops affecting trade favorably. Few major industries show recovery.

[E] Smaller plants opening up. Building more active. Several industries more active.

[F] Railroad earnings up. Agriculture best in three years. Slow improvement indicated.

[G] Depression not completed in northern area. Recovery under way elsewhere. Money plentiful for business expansion.

[H] Merchandise stocks reduced. Confidence reestablished. Building and contracting active. Savings accounts up.

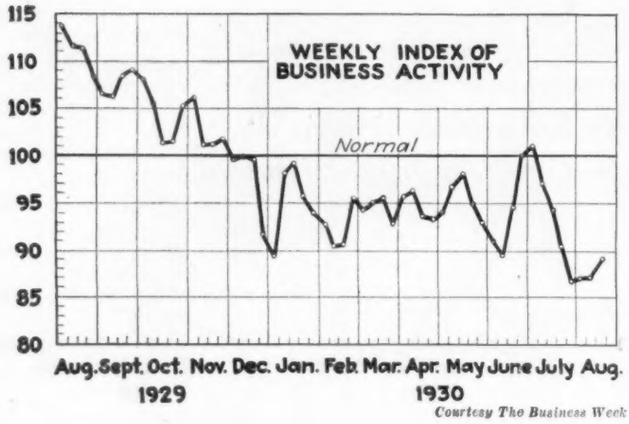
[I] Money scarce and business inactive. Lumber industry in very bad shape.

[J] Building projects increasing. Industries slowly reviving. Savings accounts up slightly.

BUSINESS in this country apparently is on a slow up-grade. Almost unanimously utility executives in all parts of the country say the worst is over in their territories and believe that a slow recovery of business is taking place. These executives are in a position to judge conditions in their service territories impartially and accurately and replied frankly to a confidential questionnaire sent them by ELECTRICAL WORLD.

Assembling the data yielded by this questionnaire with that provided by its various sources of information, the ELECTRICAL WORLD reaches the following conclusions: Definite indications of recovery are now in evidence, although they are yet few and although industrial activity continues virtually static. Commodity markets show a slightly improved tone, indicating that the decline in commodity prices has probably been checked. Confidence is slowly returning and, despite the stagnant condition existing in many lines, it would take only a slight improvement in certain basic lines to induce buying of materials and equipment. Most factors point to a slow and rather painful upward trend, gathering momentum gradually as it goes. The direction, at least, seems to be definitely right. Savings bank funds are accumulating and the banks have plenty of money for expansion.

The first question asked was: "Do you believe the worst of the business depression is over in your territory?" Nearly all answers were a positive "Yes." One executive in the East is "doubtful." Another says, "No opinion until the middle of September." Another in the Southwest says, "Not in this section." With these exceptions all sections report a positive sentiment that the worst is over.



Courtesy The Business Week

The second question asked was: "Upon what evidence do you base your opinion?" Some of the answers were: West—"Reduced stocks of merchandise." "Placing orders by retailers." "Change of mental condition of buying public." "Increased employment." "Agriculture is better than in past three years despite drought." Southwest — "Betterment of business in several lines of industry." Atlantic — "Requirements of the public are such as to prevent production going lower." "Comparative experiences in previous depressions, improvement in some industries, industrial executives' opinions." Middle West—"Smaller plants are beginning to open up here and there." "Larger plants report more orders." South —"Stimulation due to incoming cotton crop." "Unusually good crops even with lower prices will aid business here." New England—"Our sales now holding their own rather than decreasing."

In the negative we find: Middle Atlantic—"Upon action of power sales and employment." New England—"Vacationists not spending." "Power sales down, unusually long factory vacations." Southwest — "Drought and oil production restrictions." Thus, on the whole, there is tangible evidence to most utility executives that a slow up-turn is under way.

In reply to the third question, "Do you believe business will recover rapidly or slowly?" the unanimous answer was, "Slowly."

The next question was: "What industries in your territory seem to be recovering most rapidly?" Typical answers are: West—"Food, agriculture and livestock; railroads." South—"Automotive parts, furniture, steel and steel products; building." Middle West—"Building; wire drawing, radio, gasoline pumps." New England—"Silk." Middle Atlantic—"Shipbuilding, oil refineries, chemicals." A few report no appreciable recovery of industries in their territory, but the large majority name tangible industries that are recovering.

The next question was: "What industries were most affected by the business depression?" Typical answers follow: West—"Building, contracting, manufacturing and railroads." South—"Lumber, railroads, textiles and furniture." Middle West—"Steel and steel products." Atlantic—"Textiles, steel, rayon, automotive, building, rubber, automobile accessories and chemicals." New England—"Automobile accessories, manufacturing."

In general, the steel and steel product industries associated with automobile manufacture and the textile industry stand out as those affected most seriously by the business depression.

The next question referred specifically to the power and light industry. It asked what was the decrease or increase in energy sales up to August, this year, as compared with that of the same period last year. The majority of replies showed rather slight increases in power and substantial growth in domestic sales, where the increases ran as high as 25 per cent. Decreases, however, were not lacking, especially in power sales. One amounted to 24 per cent in power sales and another to 14 per cent.

While a variety of answers were given to the question as to whether the depression has induced any appreciable reduction in utility building programs and budget expenditures, the majority answered in the negative. Only two indicated a reduction in transmission expenditures and one in the substation and distribution program.

Another question asked whether or not the reduction in general commodity prices was reflected in lowered prices for electrical and mechanical equipment and in labor and in building material costs. Replies were evenly divided. One or two called attention to the effect of lower copper and lumber prices, but few admitted any saving through reduced labor costs, except in the case of unskilled labor.

The two last queries have to do with the money situation. One asked whether savings accounts are in-

Executive Opinion Stresses These Conditions:

——Savings funds have accumulated in a large way and bank funds are available for expansion, although banks in many cases are more rigid on collateral requirements.

——Incoming crops are helping to revive trade in many sections despite the results of the drought and the price situation.

——Certain industries show definite indications of improvement. These include building, agriculture in many sections, railroads, steel and steel products industries, pulp and paper, oil refining, etc.

——The general business trend seems definitely upward at the moment, as indicated in the attached chart based on eight series of weekly figures, compiled by the *Business Week*. While it is yet uncertain whether this is merely a temporary upward swing, to be followed by recession, expert opinion apparently anticipates a definite upward trend from now on, although it may take many months or a year before business again hits its normal pace.

creasing in the territory concerned. The other asked whether or not banks are able to supply needed money for industry at reasonable rates. The majority answered both questions in the affirmative. One pointed to a decline in deposits. Two referred to the difficulty of securing needed funds and one explained the difficulty thus: "There are enormous amounts of frozen assets in mortgages on real estate in and around this Middle West territory. Real estate men, in general, probably will have to do a certain amount of house cleaning before banks will be more liberal in their loans."

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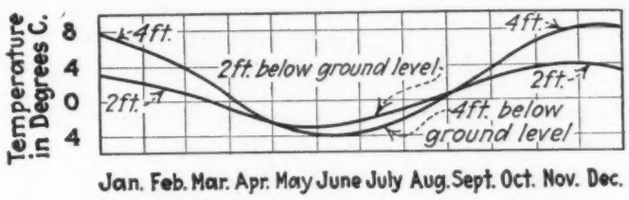
Earth Temperatures Analyzed for Cable Rating Use

THE temperature of the earth varies widely within a given city, depending upon the depth below the surface, moisture in the soil, paving, or the proximity of large buildings. Individual studies of earth temperatures



Average difference between earth and atmospheric temperatures

To determine the earth temperature at any period of the year add the value from the curve to the normal atmospheric temperature for that period.

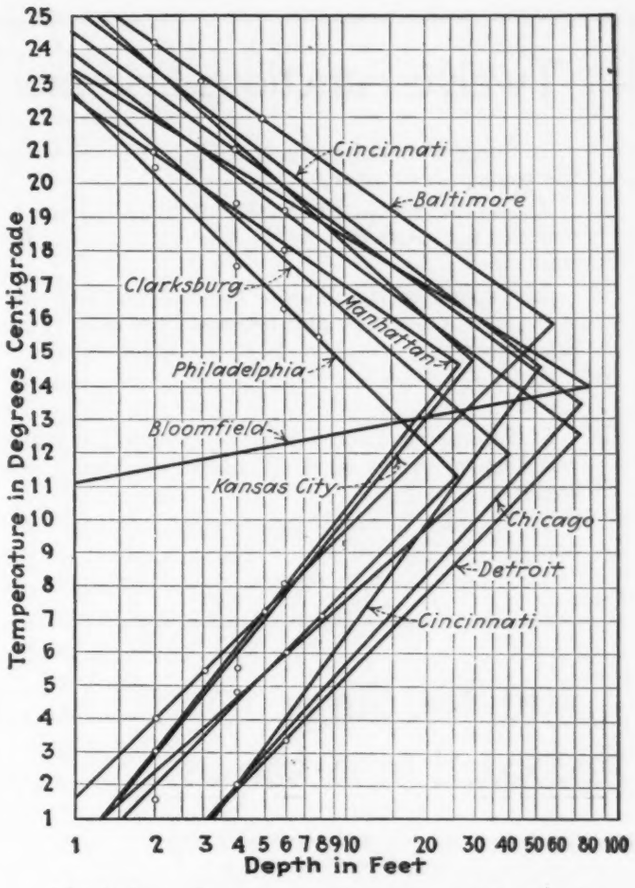
in thirteen cities throughout the United States are given in a recent report of the underground systems committee of the N.E.L.A.

Underground temperatures vary with the depth below the surface, the maximum temperature decreasing and the minimum temperature increasing with the depth. The earth temperature at one particular locality seems to repeat itself with reasonable accuracy each year, following a curve essentially sinusoidal. However, the earth temperatures show considerable variation as between localities.

Paving and a high percentage of moisture in the soil in most cases increase the maximum summer temperature and decrease the minimum winter temperature. There is no consistent relation between the mean air and earth temperatures, the difference between the mean monthly air temperature and the earth temperature for each month at any depth varying for each city.

The maximum and minimum earth temperatures lag the corresponding air temperatures by a period of time from two weeks to a month, increasing progressively with the depth, the lag at the surface probably being practically zero.

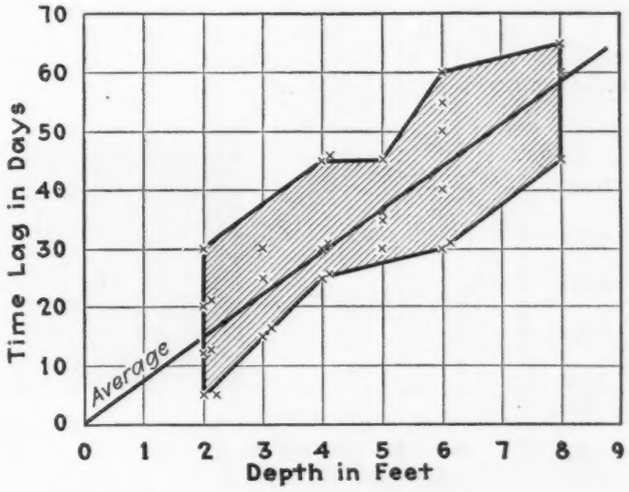
Three different methods were used by the companies co-operating in the temperature measurements—thermocouples, thermometers, and in one case a resistance



Variation of earth temperatures with depth

The points of intersection of the maximum summer and minimum winter curves extrapolated give the depth at which there will theoretically be no seasonal variation.

buried in the ground. The results obtained by this variety of measurements, when coupled with numerous other varying conditions, are not strictly comparable, and what discrepancies were found may probably be traced to this cause.



Time lag between earth and air temperatures for various depths

Twelve Functions Essential in Farm Service Department*

1. Study and analyze the possible farm load within the company's territory.
2. Outline a plan of development which will be flexible to meet the needs and policies of the company.
3. Map all existing lines of the company and keep a record of costs, uses and revenue from every farm line extension.
4. Have a voice in all matters affecting rural development.
5. Become acquainted with every farm customer and keep a record of the farmers' equipment and business.
6. Organize a consulting service for farm customers.
7. Assist educational agencies working with the customer.
8. Keep informed on every available piece of farm equipment to use electric energy.
9. Conduct experiments and demonstrations with new electric farm equipment to be distributed in the territory.
10. Co-operate with implement dealers and other merchants selling a desirable product to the farmer.
11. Work for the general community welfare and see that electric equipment is available at a fair price to the customer.
12. Study and promote every means that will lead to better relations between the farm customer and the company.

**From address by R. R. Parks before Rural Service Section, Middle West Division, N.E.L.A.*

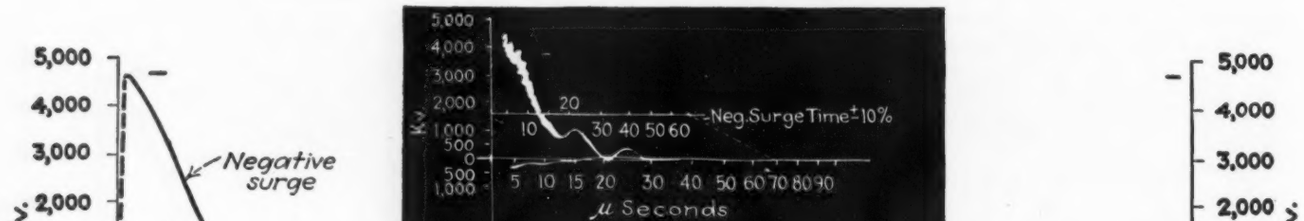
4,500-Kv. Surge Recorded in Arkansas

By J. J. TOROK
Transmission Engineer
Westinghouse Electric & Manufacturing Company

ENGINEERS, for the past few years, have been trying to determine the manner in which lightning affects transmission lines. Their early labors were rewarded by a measure of success, but the relatively low insulation of the lines under investigation limited the voltage they could measure, since the very high voltages that are the most important flashed over the insulation and distorted the records.

An excellent opportunity to increase the limits of the voltage range over which measurements can be made is afforded by the use of lines of all wood construction. The Arkansas Power & Light Company and the Westinghouse Electric & Manufacturing Company are now collaborating in an investigation on a 110-kv. line which has been selected as most suitable for such work. The section of line under investigation was especially constructed to provide a high lightning strength, being supported by wood-pole structures of the H-frame type, 29-ft. crossarms and six suspension insulators. Wood braces were substituted for guys to bring these points up to the strength of the tangent structures. The lightning insulation of the line is estimated at 7,000,000 volts. The nature of the line construction is such that practically all the desirable information so necessary in such work can readily be obtained.

In the early part of April a cathode-ray oscillograph was installed on the Camden-Magnolia line, and the day the apparatus was put in operation a heavy thunderstorm appeared which lasted for three days. During this time more than fifteen valuable records were obtained. One of these records, which is reproduced here, is, as nearly as can be correlated, the result of a direct stroke to the line about 2½ miles from the oscillograph causing a structure to flash over. The potential as recorded at the oscillograph station rose to more than 4,500,000 volts in approximately one microsecond. This is believed to be the highest voltage ever recorded on a transmission line.



Oscillograph record of 4,500-kv. surge and replotted curves to aid analysis

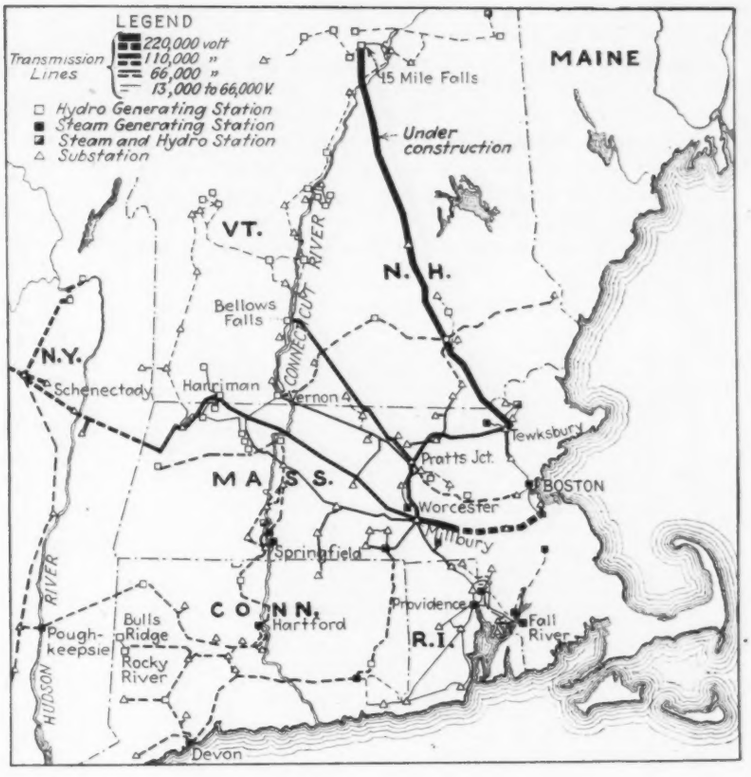


Fig. 1—Fifteen-Mile Falls-Tewksbury line will bring nearly a quarter million kilowatts to market

Service Controls 15-Mile Falls Transmission

By CLYDE A. BOOKER

Assistant Transmission Engineer
New England Power Construction Company

ONE of the concluding remarks of the author in the ELECTRICAL WORLD, September 15, 1928, in describing certain 110-kv. semi-flexible tower lines then under construction for the New England Power Company was that no difficulty was anticipated in adapting the design to higher voltages. In the intervening period this type of design has been applied to a 220-kv. line, 126 miles long, which is being built between northwestern New Hampshire and eastern Massachusetts. Some of the problems of design involved in this work are reviewed in this article.

The line originates at the company's Fifteen-Mile Falls hydro-electric plants now under construction on the upper Connecticut River near Littleton, N. H., and St. Johnsbury, Vt., where some 250,000 kw. will be generated. Pending the development of increased load in the Twin States, the great bulk of this power will be transmitted to Tewksbury, Mass., at which point it can be readily absorbed in the 110-kv. network of the New England Power Association. The accompanying map shows the geographical relation between the development, the line and the distribution network.

The line is designed for much greater capacities than any now operating in New England. Its length and the large block of power to be delivered require a voltage higher than any heretofore used in this section of the country.

While preliminary investigation seemed to favor three 150-kv. circuits, it later developed that the power could be transmitted more economically on two circuits of 220 kv., the extra space on the 350-ft. right-of-way being kept available for an additional circuit if needed. The system stability with 220-kv. operation is of course better than with the lower voltage.

Diameter of conductors selected

Inasmuch as all other parts of a line are used merely to support or protect the conductors, one of the first things to be decided after the voltage is known is the size of conductor. Systems operating at 220 kv. should have conductors about 1 in. in diameter on account of corona losses. Only two types of conductor were considered suitable for this voltage, viz., the largest sizes of steel-reinforced aluminum cable, which is nearly standard for heavy lines, and Anaconda hollow copper

cable, in which an extra large diameter is secured by stranding the copper wires over a twisted I-beam core.

For this line sizes of conductor having the 1 in. diameter and conductivities equal to or greater than 380,000-circ.mil copper were investigated, 500,000 circ.mil or equivalent proving to be the most economical size. When the order for the conductor was placed copper was at a disadvantage because of a rising market, so that aluminum was purchased.

Since the whole design of the line is developed around

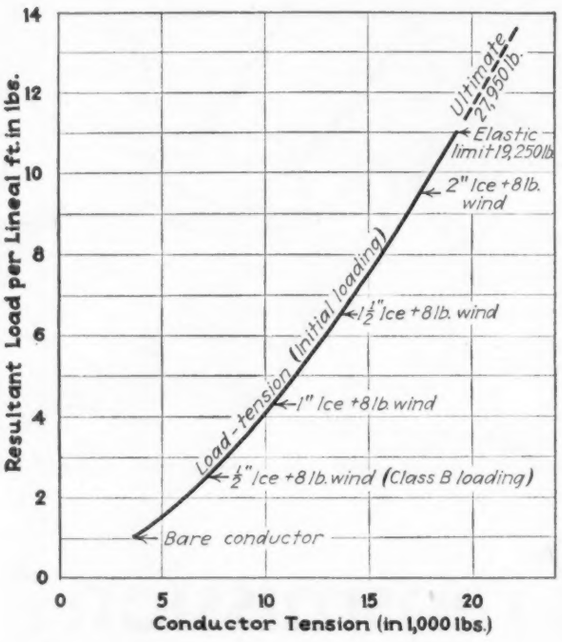

Resultant Load per Lineal ft. in lbs.
Conductor Tension (in 1,000 lbs.)
Ultimate 27,950 lb.
Elastic limit 19,250 lb.
2" Ice +8 lb. wind
1½" Ice +8 lb. wind
1" Ice +8 lb wind
½" Ice +8 lb. wind (Class B loading)
Bare conductor
Load-tension (initial loading)

Fig. 2—Load-tension curve for power conductors

the conductor, a description of it will be interesting at this point. We are using 795,000-circ.mil aluminum steel-reinforced cable with 61 strands, 54 of which are aluminum, surrounding a seven-strand galvanized steel core. Each of the strands is 0.1214 in. in diameter, making a total over-all diameter of 1.093 in. for the completed cable. The cable weighs 1.024 lb. per lineal foot and has an ultimate strength of 27,950 lb. with an elastic limit of about 19,000 lb.

Sag and conductor stresses

Experience has shown that in a rugged territory subject, like New England, to frequent severe sleet storms, the most satisfactory lines are those constructed on a horizontal spacing with an average span of about 600 ft. and having a loaded wire sag of about 18.5 ft. This span and sag have also proved quite effective in reducing the number of structures where special precautions have to be taken to prevent excessive deflection of suspension insulators because of lack of weight when a tower must be located in a depression. When this span and sag are applied to the conductors used on this line it results in a tension of 6,000 lb. under ½-in. ice, 8-lb. wind and 0 deg. F. loading condition. The conductor having a strength exceeding 4½ times this tension, it is interesting to see the amounts of external load that can be carried when it is so sagged.

The accompanying curve shows that the conductor when so sagged will carry an ice and wind load of 11 lb. per lineal foot or ten times its own weight when stressed to its elastic limit of about 19,000 lb. This is equivalent to a 2¼-in. radial thickness of ice, accompanied by a 60-mile wind. This hypothetical loading is about twice anything yet encountered on our system.

Ground wires guy towers longitudinally

The ground wires selected for use with this size of conductor are ½-in. diameter galvanized extra-high-strength steel strand having an ultimate and elastic limit comparable to that of the conductor. It is found that when this wire is sagged 14 ft. (corresponding to a loaded wire tension of 5,000 lb.) its characteristics under load are very similar to the conductor. This very heavy ground wire was selected because one of its functions is to serve as a longitudinal guy for the semi-flexible towers.

The investigations resulting in the loading data shown in Fig. 2 seem to justify the belief that wires so sagged cannot break under any probable conditions of load, unless the wire is very severely damaged either during construction or by electrical flashover after being placed in operation. All tower loadings were therefore based on the assumption that if breakage does occur it will be at a tension not exceeding the elastic limit because of such damage.

It seemed possible to design the line so that practically all cases of trouble arising from mechanical faults could

Summary of Design

1. Length 126 miles.
2. Conductor 795,000-circ.mil A.C.S.R. tension, class B load 6,000 lb.
3. Ground wires ½-in. extra galvanized plow steel tension, class B load 5,000 lb.
4. Average height of conductors above ground 40 ft.
5. Theoretical maximum induced voltage 1,800 kw. outside conductors, 1,300 kv. center conductor.
6. Single fifteen-unit string of standard strength 10-in. disks for suspension.
7. Single seventeen-unit string of heavy duty 10-in. disks for dead-ends.
8. Impulse flashover 2,400 kv. based on Pittsfield wave.
9. Conductors and ground wire will carry 2¼-in. radial ice and 8 lb. wind.
10. Capacity about 250,000 kw. (one section out).
11. General dimensions of standard tower: Height, 55 ft.; spread at ground line, 19 ft.; transverse, 3 ft. longitudinal; spacing of conductors, 23½ ft.; spacing of ground wires, 25 ft.; depth of two footings, 7 ft.; wire supported, 44 ft. above ground.
12. Average span, 592 ft.
13. Total number of towers, approximately 2,260, or 8.94 per mile.
14. This type of line makes possible use of a greater number of supports at no sacrifice in construction cost.

Tower Data

Total (of Circuits)	Type of Structure	Per Mile of Circuit
1,885	Semi-flexible suspension towers	7.46
222	Suspension anchor towers	0.879
76	Full anchor towers	0.301
28	Full anchor towers for heavy angles	0.107
24	Transpositions	0.095
24	Special railroad crossing towers	0.095
2,259		8.937

be eliminated, at least theoretically. It seemed apparent that the principal obstacle to uninterrupted service would be troubles caused by lightning, either induced disturbances or direct strokes.

Theoretically, at least, much can be accomplished in the reduction of troubles by simply keeping the wires as low as permissible and installing as many ground wires as can be economically justified. The type of construction adopted for this line combines these points to such an extent that it is possible to design the insulator string with a margin above the maximum theoretical induced lightning voltage.

In locating our towers we have maintained clearances equal to the next even foot above the National Electrical Safety Code requirements. This, in general, has meant 27 ft. above the ground, because out of the 5,370 acres included within the 350-ft. right-of-way there are only about 600 non-wooded acres.

Careful study of typical profiles indicated that it would be possible, with this type of construction and with the above clearances, to maintain a grand average clearance above ground not exceeding 40 ft. This indicates that

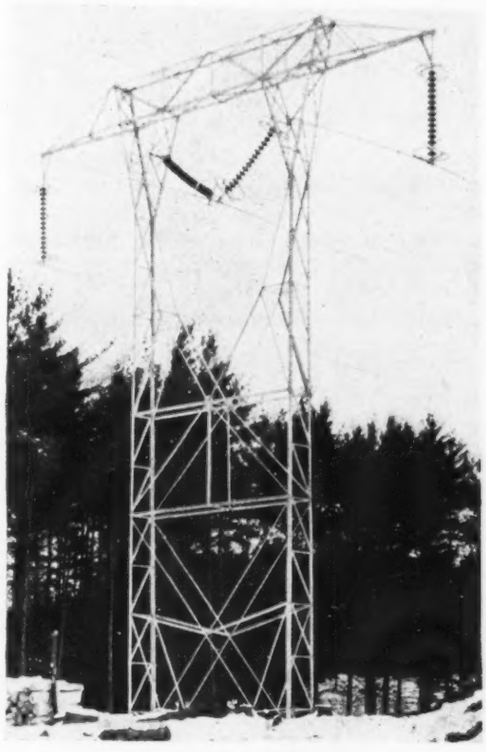


Fig. 3—Semi-flexible tower

the maximum induced voltage would be on the order of 1,800 kv. on an outside and 1,300 kv. on the inside conductor, the protective value of the ground wires having reduced these figures from 4,000 kv. Higher voltages may, of course, be experienced in case of a direct stroke.

A string of fifteen standard 10-in. insulator units spaced 5¾ in. apart and shielded with oval rings 24x40 in. in size both top and bottom has the following characteristics: Dry flashover, 60 cycles, 670 kv. effective, 950 kv. crest; wet flashover, 60 cycles, 580 kv. effective, 820 kv. crest; flashover impulse at lightning frequency, 2,400 kv.; ratio impulse flashover to estimated maximum induced voltage, 1.33 for outside and 1.85 for center conductor.

The impulse flashover voltage was determined by lightning generator tests having the so-called "Pittsfield Standard" wave form characteristics.

The oval grading rings, 24x40 in., are designed with the following characteristics in mind, mentioned in order of their importance: (1) Protection against conductor burns in case of flashover; (2) maximum increase in impulse flashover; (3) protection against cascading.

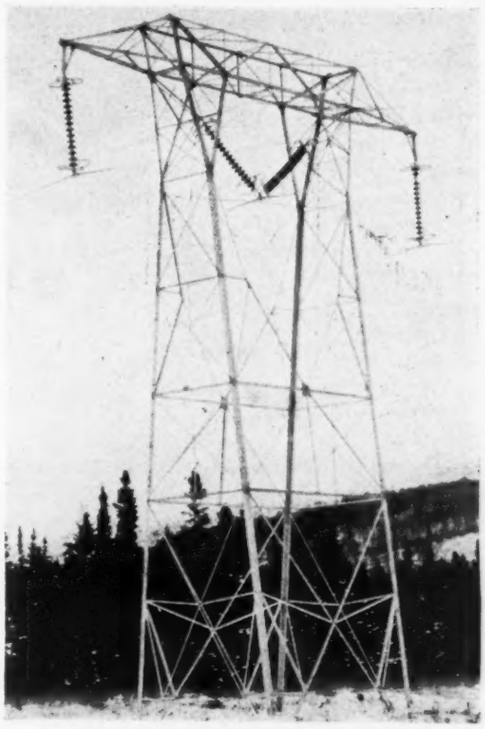


Fig. 4—Suspension anchor tower

This is placed last because it is felt that cascading will do little damage to a properly designed disk and it is believed the line is so designed that flashovers will occur only during extraordinary lightning storms.

Thus the proper amount of insulation for this particular line was determined. The fifteen-disk string, including hardware, is 8 ft. 1 in. in length, which, with the 7-ft. 2-in. clearance to ground required is the figure that controls the configuration of our steel. The clearance from any live part to steel is not less than 7 ft. 2 in. under the worst condition of blow-over, which is assumed to be 45 deg. from the vertical. In order to maintain this clearance a flexible hanger 2 ft. 9 in. long is used at the outside suspension insulators.

Determination of span length

The design is now developed to the point where all elements affecting the configuration and strength of the towers are known, except the definite determination of the length of span.

The following consideration helped to the conclusion

that it would be most satisfactory to continue, at least in our territory, the length of span and sag which has proved most suitable on similar lines at lower voltages: (1) Increased conductor safety as explained above; (2) reduction of uplift troubles; (3) shorter spans make use of single strings of standard strength insulators practical at suspension locations because of reduced vertical loads

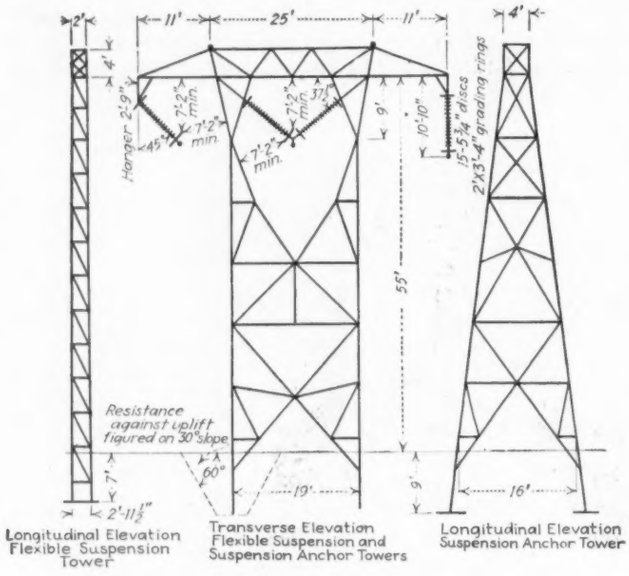


Fig. 5—Detail of flexible suspension and suspension anchor tower

during severe sleet periods; (4) lower conductor tension makes single strings of heavy-duty insulators practical at dead-ends; (5) provides grounds at more frequent intervals, tending to more positive relay action and to quicker dissipation of transients.

Center bridle suspension utilized

While our first designs were based on the conventional square tower, it was felt that if the semi-flexible type of line could be developed for the higher voltage very practical benefits to service would result. This at first seemed impractical because of the great width required to secure clearance for the center conductor (about 30 ft. between main legs), which would have resulted in a very weak, flimsy tower. This width was due to the swing of the center insulator, and if a practical solution was to be found in the semi-flexible design it seemed necessary to devise some method of maintaining this conductor in a fixed position.

Several methods were available. Dead-ending the center conductor at every tower was discarded because of excessive cost and construction difficulties. Installation of tie-downs was discarded because of the toggle effect on the tower. The swinging bridle arrangement as actually adopted maintains at the expense of one extra insulator string all the advantages of the suspension insulator in flexibility along and across the line, but restrains the radius of transverse motion to a very small value, which in no way affects the vital clearances, since the insulators themselves are fixed in position.

This type of insulator assembly had been in use for a number of years on certain lines owned by subsidiaries of the Aluminum Company of America. While the former use had been for the purpose of securing an offset on the center conductor of a vertical line, it had operated with entire satisfaction. The insulators as used in our assembly are brought together at such an angle that there can be no reversal of stress so as to relieve the leeward string of all weight. At the same time, the insulators forming the bridle are under less mechanical stress than the suspension strings on the same tower.

Observation of the completed portion of the line during high winds indicates that the center conductor blows in unison with the outside conductors. The conductor spacing during windstorms is, of course, decreased on the one side and increased on the other side by the amount of the transverse deflection in the insulator strings.

Upon completion of our tower designs, we found that the saving in steel of the semi-flexible type made possible by the bridle insulator amounted to several times the cost of the extra string of insulators. Other practical benefits are a 30-ft. saving in width of rights-of-way and clearing, elimination of a considerable amount of side hill troubles and insuring a more effective location of ground wires.

Design of tower units

We now pass on to the design of the supporting structure. Except for the dead load of the tower itself, together with the relatively small effect of any wind load thereon, all loads in the structure must be induced by the wires attached. The semi-flexible type of line is divided into a series of structural units consisting of a rigid tower at either end, one or more flexible suspension towers and two overhead ground or guy wires securely fastened to every tower.

The flexible suspension tower upon which the successful design of this type of line depends has certain distinct functions in the structural unit as follows: (1) Support weight of conductors, insulators, etc.; (2) resist transverse load on wire and towers due to wind; (3) deflect under longitudinal loads, so that these loads are

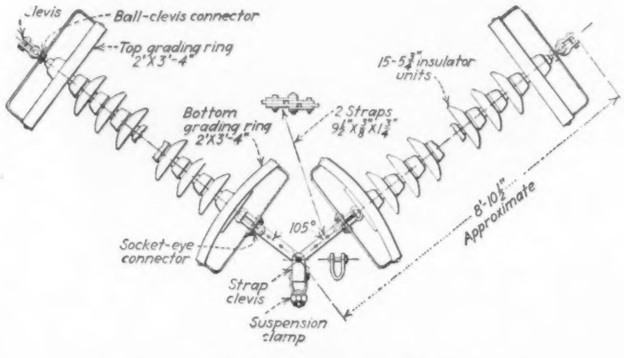


Fig. 6—Detail of standard V-string for bridle suspension

always balanced by the wires supported; (4) sufficient rigidity for construction purposes in erecting towers and stringing wires.

The loading on the tower was determined for a maximum span of 1,000 ft., with special precautions to take care of exceptionally heavy vertical loads which may

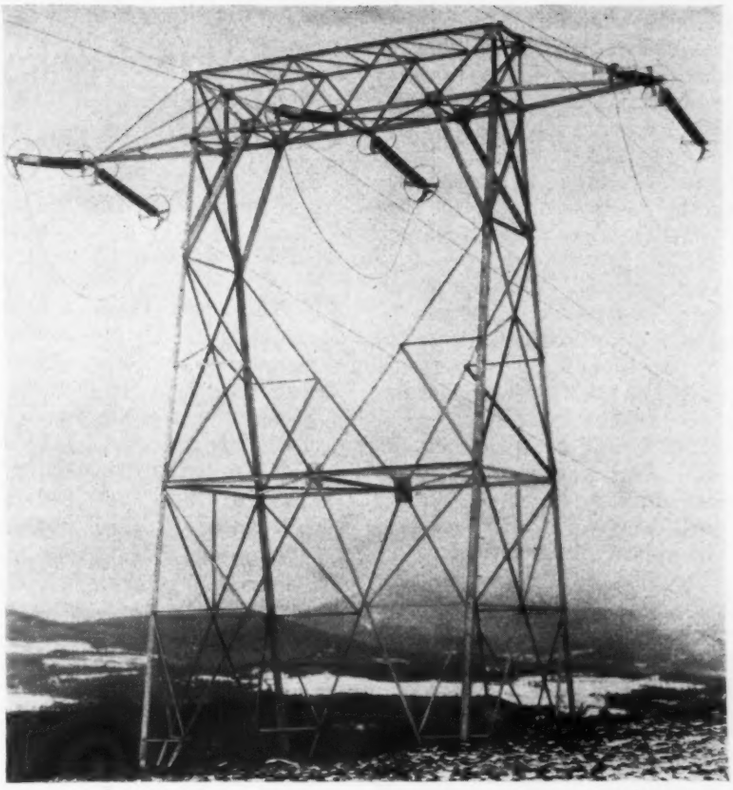


Fig. 7—Full anchor tower

come from extraordinary sleet, or through the location of a tower on a pinnacle. The standard tower (Fig. 3) is 55 ft. to the crossarm, 19 ft. x 3 in. at the base. On this type of tower steel grillages having sufficient area to develop the uplift are used exclusively, even at rock locations, in order to preserve the ground line flexibility undiminished. The legs are flared out above the knee brace to secure a more favorable position of the ground wires in reference to the outside conductors. We also found from a careful comparison of wooden models that the appearance of the towers is improved somewhat over the straight-legged type.

Anchorage practice detailed

At intervals not exceeding seven spans, a square tower is used to provide longitudinal stability. These towers consist of two distinct types. The suspension anchor tower is used most frequently and is designed for suspension construction only, to prevent any possibility of longitudinal oscillation by firmly attaching the ground wires at ¾-mile intervals. This tower will hold both ground wires pulling at their elastic limit (19,000 lb.), or all three conductors at their tension after coming to rest from breakage at the elastic limit. This tension is considerably reduced when the suspension insulator swings into the span.

The full anchor tower for use only as a dead-end is inserted at intervals not exceeding 3 miles and at all angles and at transpositions. The full anchor is designed to hold all wires pulling at their elastic limit and for angles up to 15 deg. we have also an additional anchor design for angles between 15 deg. and 45 deg.

The ground wires are each clamped at the tower with two rigid ground wire clamps, no play being permissible because of their function in sustaining the longitudinal loads of the semi-flexible towers. Figs. 3, 4 and 7 show the semi-flexible, suspension anchor and full anchor towers respectively.

The two circuits now under construction are spaced 183 ft. from center to center on a 350-ft. right-of-way. This is done to make them as near independent electrically and structurally as practical without purchase of separate rights-of-way. Space is thus left for a third circuit between the present two. The lines will be sectionalized with oil circuit breakers at the center point. An arrangement has been provided that eliminates a common bus at this point, and the wires will be completely transposed twice on both sides of the sectionalizing station, the actual transposition being made on auxiliary poles entirely separate from the line structure, which is a standard full anchor tower. Tapered aluminum armor rods 98 in. in length are being used at suspension locations, not so much to protect the conductor from vibration, which is not expected at the low tension used, as to give additional protection from burns in case of arc-over. These rods when twisted in place extend 27 in. outside of the oval ring.

Construction has been in process for about a year and it is expected to energize the line about October 1, 1930, a considerable portion now being completed. This opportunity is taken to acknowledge the company's appreciation of the co-operation of the following groups in arriving at the design just described: General Electric Company, Westinghouse Electric & Manufacturing Company, American Bridge Company, Aluminum Company of America, Locke Insulator Corporation and Ohio Insulator Company. Each of these companies has done important research work which has contributed to the design, and in addition some of them are furnishing materials for use on the line.

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Selecting the Activity for Residential Relighting

By M. LUCKIESH

Director Lighting Research Laboratory, Nela Park, Cleveland

WITH 75 per cent of the kitchens having obsolete fixtures and few of the remaining 25 per cent really modern, it was obvious that this room in the home held the greatest single opportunity for better lighting. The results which have followed warranted this assump-

tion. One company has found it profitable to conduct eight activities during the last six years. Obviously, one activity does not exhaust the opportunity, for this company still has two out of every three wired homes as prospects for modern kitchen units.

The combination porch light and illuminated house number, due to simplicity of installation, moderate price and results obtained, can be readily sold. Necessary lighting education of the sales organization is easily acquired.

Next in order comes the bedroom or dining room. One out of every two bedroom fixtures in use can be classed as obsolete. Satisfactory bedroom fixtures can be made costing less than dining-room fixtures; personal taste is more readily satisfied and the lighting education of the sales organization need not occupy any considerable amount of time. In the homes of industrial workers the obsolescence and unsatisfactoriness of dining-room fixtures are high. In many of these homes the dining table affords the most satisfactory place for reading, studying and sewing. The appeal for saving the eyes of children in these homes affords a powerful sales argument. This activity should be carried on by a sales organization that is thoroughly grounded in lighting principles and facts pertaining to saving our eyes and particularly the eyes of children.

Although living-room activities have been carried on after kitchen-unit activities, it appears that it would be better to defer this activity until the sales organization has had experience with practically all of the previously discussed items. The best understanding of lighting possibilities is needed in the living room, for the purchaser exercises personal taste more fully, competition with portable lamps is greatest and the price of the fixture is usually greater than the price of the fixtures required for other rooms in the home.

In addition to these activities, there remain such activities as the portable lamp, the unit for the laundry and garage, and also incandescent lamp sales. The portable lamp appeals to the renter because of its mobility. Inasmuch as the rented home constitutes one-half of the total, this is of importance. Future portable-lamp developments will create added interest in this lighting device. Experiences gained from kitchen-unit sales are invaluable in selling laundry and garage lighting.

Directional Relays Corrected Trouble

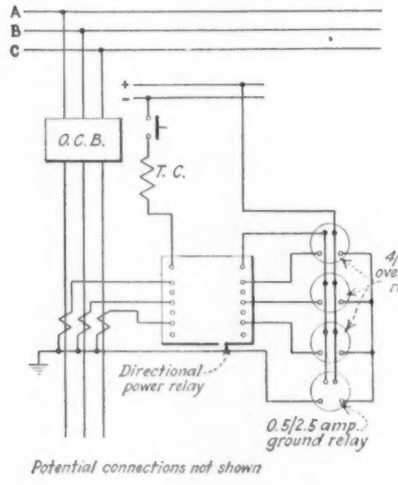
By F. J. ANDERSEN and G. E. DANA

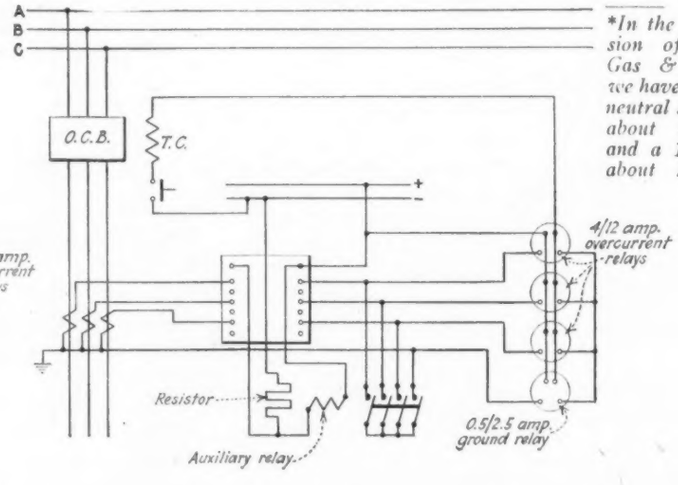
Operating Department,
Associated Gas & Electric System, Binghamton, N. Y.

IN THE past standard overcurrent relays and low-energy ground relays, whose contacts were in series with those of the power directional relay, were used to protect the Binghamton division of the Associated Gas & Electric System,* but considerable difficulty was experienced from the incorrect operations. If a fault occurred at some point beyond a substation, the contacts of the overcurrent relays closed and those of the directional relays remained open as desired. However, after the fault was cleared, surges or normal load current caused the directional relays to close their contacts before the overcurrent relays could reset. This action often tripped circuits which were not in trouble. Most of the difficulty was experienced with the ground relays, which require a long time to reset.

This difficulty was overcome by using directional control schemes, which, although not new, have not had as wide an application as they deserve. The general scheme is shown in Fig. 2. An auxiliary relay is used to short circuit the coils of the overcurrent relays when power is flowing into the bus from this line. Thus the overcurrent relays cannot start to operate until the power flow is in the correct direction for tripping the breaker. Upon the occurrence of a fault on this line, the directional relay closes its contacts and short circuits the coil of the auxiliary relay, which in turn drops out. This removes the short from the coils of the overcurrent relays, which are left free to function and trip the breaker.

There are many variations of this scheme which may be applied to both single-phase and polyphase power-directional relays, but the application shown is typical and explains the general idea. We have found that some form of directional control relaying is indispensable in many locations.





**In the Binghamton division of the Associated Gas & Electric system we have a 33-kv. grounded neutral system comprising about 500 circuit-miles and a 110-kv. system of about 250 circuit-miles.*

Figs. 1 and 2—Relay connections before and after correcting faulty operation

READERS' FORUM

New Data on Czechoslovakia's Output

To the Editor of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD, Vol. 96, No. 2 (July 12, 1930) page 89, interesting statistical data about energy output in 1929 appeared. The Czechoslovak Electrical Association wishes to remark that the output of Czechoslovakia is to be estimated higher than 1,700,000,000 kw.-hr. According to our statistics, which include both the energy generated in public utility plants and in industrial establishments, the total output of energy generated in 1928 was 2,900,000,000 kw.-hr. In the year 1929 the statistics, including the greater part of plants, show an increase of the yearly output of 15 per cent, so that the total electrical output of Czechoslovakia for 1929 may be estimated at 3,300,000,000 kw.-hr. We would be obliged to you for a correction in one of the early issues of the ELECTRICAL WORLD.

BESINSKY,
President.

Elektrotechnicky Svaz, Ceskoslovensky,
Vocelova 3, Praha XII.

[The figure published in the ELECTRICAL WORLD was quoted from another source, as was stated in the article, but appears to rest upon the same authority, though for an earlier year. It is the output for 1927, according to an item in our issue of October 19, 1929, page 801, taken from the Year Book of the Czechoslovak Electrical Association.—EDITOR.]

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The Utility Manager of a Small Town Suggests:

To the Editor of the ELECTRICAL WORLD:

Being a cog in the machinery of an industry so vital to the social and economic well being of our nation and being one of the lesser lights who can see and realize that the executives of public utilities are confronted each year with more intricate problems, I wish to express the viewpoint of a manager of a very small town for your approval or disapproval, as the case might be:

> H———, what's the use of doing that, Jack, the boss won't know anything about it? He can't see anything but a curve, a few fool figures or your name on a sales order. Find the customer who writes him when things don't go to suit him and pat that customer on the back and let the customer that is quiet and don't amount to a d——— go. Our officials have made it plain that is all they see or care about. Anyway, every fellow from headquarters makes it clear he wants his boots licked, so that's what I do, since I see the bootlickers are the fellows who get promoted. I used to take an interest in the work whether they knew it or not and helped my buddy do his job and spent a lot of time making personal friends, since the local employees are the company to the customer. But I soon found out that to do these things made me get behind with my routine work and the fellow interested only in getting his name on paper at anybody's expense and made the boss like him at any cost was getting the promotion.

Thoughts and statements like these are becoming too common, although they are not warranted. They are brought about by a misunderstanding on the part of both the officials and the employees and because public utilities are growing to such an extent that personal contacts are being sadly neglected.

Drives are being made to load the electric lines by sales of merchandise, and in the enthusiasm to make these drives a success many important angles are being overlooked. The policy by which these drives are being made is breeding within the mind of the young employee selfishness and places a money value on everything he does or wishes to do. The system in its true sense is a *drive*, and the best men in this country do not have to be driven when approached from the proper angle. The best work is done by those who do their work for the love of the thing well done, and even the best men like to know their work is appreciated. The necessary feeling of pride cannot be bought.

The man who has to be paid for everything he does usually does more than he is paid for, and the system which requires him to sell something for a commission before he can make a decent income has a very bad aspect. If the man is the type he should be, he will do a better selling job when he can feel that he is not being driven with the whip. It is high time that loyalty and a feeling among employees that "I am proud I am an employee of this company" is recognized with a "Hello, Jack, we like the interest you have in your work and the help you are giving the other fellow, and the interest you are taking in your customers, regardless of their social or business standing. We are with you and we appreciate your interest."

Too often a man who has his whole heart in his work has had the heart (so to speak) taken out of him by some superior who either did not understand him or was not big enough to realize that it was help he needed rather than criticism. The best men do not advertise what they do, much preferring to do things and leave the "horn tooting" to the big-mouthed chaps who haven't time to do the little disagreeable jobs which get them no publicity. Yet very often these little jobs must be done well if successful operation is to be had.

The writer has not yet reached middle age, but during his period of employment in this important industry he has worked in organizations that were managed in several different ways. He has seen engineering the most important phase of the game; then sales of merchandise or household appliances seems to be the most important angle at this time, and rightly so, and I see looming on the horizon the problem of public relations as the major industry interest. In my eyes, as an employee in a very small capacity, the solution to these conditions is:

1. Place executives at the head of state organizations who do not drive, who have the capacity to know a man when they see one and who will not place at the head of departments some boy who has made high grades at school but has not experienced the rough and tumble of practical life nor the practical side of operation.
2. Place in the small official positions only those who have received the necessary education which will enable them to handle the technical problems that arise and only those who in addition to having this knowledge have gone through the grind and know what tired muscles are and have learned to understand the feelings of subordinates.
3. Place in each local town, no matter how small, only a man who has a sincere interest in serving his customer as well as his company. Then pay him a salary on which he can live in a good neighborhood and participate in social functions. This will eliminate the inferiority complex when he comes in contact with the leaders of his town.

All the printed matter which can come from the best writers will never have the effect that public respect and personal friendship for each local organization will have. The type of employee relations needed will never be purchased with dollars, and a man having to depend on

a commission from the sale of something for his needed income is seldom a good public relations or employee relations man.

I would like to state that this is written with a spirit of wishing to help make our public utilities a thing both the public and employees will respect and understand. It is a sincere expression of a man who wishes to help.

A SMALL TOWN MANAGER.

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BOOK REVIEWS

Plant Location

By W. G. Holmes. New York: McGraw-Hill Book Company. 275 pages, illustrated. Price, $3.

Using unit costs as a basis, the author develops the principles to apply to find the proper location for an industrial plant. He starts with market territorial analyses and studies next raw materials and transportation facilities and rates, fuel, power, wages, labor, laws, taxation and other fundamental factors.

After the basic features are discussed the author treats of the choice of a particular community and finally discusses the choice of a particular site. The book is fundamental and valuable. It has scope and perspective and yet is full of practical methods for evaluating plant locations. It deals with a new topic in a fundamental and practical manner.

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Lehrbuch der Praktischen Physik

By F. Kohlrausch. Leipzig and Berlin: B. G. Teubner. 860 pages, 395 illustrations. Price, 23 reichsmarks; bound, 26 reichsmarks.

"Kohlrausch" needs no introduction. In the physical laboratory it has for long years been a standard reference work as to methods and constants. Since 1910, when its eminent editor laid down his pen, the work has been continued by an able group of scientists, many of them his former pupils or associates. The new edition, the sixteenth, continues the well-known form. The revisions from the preceding edition, according to the preface, relate, among others, to the conductivity of electrolytes, heat radiation, certain sections on optics and those in the field of electron physics.

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Mathematics for Electricians

By M. H. Kuehn. New York: McGraw-Hill Book Company. 220 pages. Price, $1.75.

This is a textbook for electrical students in vocational schools. The practical mathematics ranges from arithmetic, algebra, geometry to trigonometry and a large number of electrical problems are used to illustrate the application of the mathematics. The book should be very helpful to teachers and students in vocational schools and to practical electricians. It teaches both electricity and mathematics.

Street-Lighting Practice

By Ward Harrison, O. F. Haas and Kirk M. Reid. New York: McGraw-Hill Book Company. 264 pages, illustrated. Price, $3.50.

The rapid progress of the methods employed in modern street illumination has given rise to many important problems concerning this phase of lighting. These problems have to do with the purely engineering side of the matter, such as the choice of equipment based on light distribution, the proper location of lighting units, series versus multiple circuits, evaluation of glare, and installation and operating costs, questions of contractual relations, methods of financing, maintenance provisions, and even of the history of street illumination.

The answers to many of these questions have been furnished repeatedly, and it was with the thought of making available in one place such information as the authors have upon these and similar subjects that the writing of this book was undertaken. Much of their effort has been devoted to the selection and preparation of the charts, illustrations, and distribution curves, numbering more than two hundred in all, and particular care has been taken in every case to render them authoritative and complete.

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Alternating-Current Bridge Methods

By B. Hague. New York: Isaac Pitman & Sons. 280 pages. Price, $4.50.

The author has revised his former compilation of City and Guild College lectures, incorporating more subject matter on the effect of mutual inductance in networks. More consideration has also been given to high-voltage uses of bridges and the developments in the related air condensers. The text, likewise, gives more recognition to the production-test employment of the bridges formerly restricted to the field of the research laboratory. Cable and insulator tests by Schering bridge are typical of the modernizing insertions.

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Grundlagen und Entwickelung der Energiewirtschaft Österreichs

Vienna: Julius Springer. 189 pages, 94 illustrations, one map. Price, 20 reichsmarks.

Prepared as the official report of the Austrian National Committee to the World Power Conference, this volume contains a large amount of statistical and descriptive material on the fuel supply and output, the water power and electric power production in Austria. This constitutes the first three sections. A fourth section traces the past of railway electrification and outlines future prospects. Section five deals with laws and regulations affecting water power. As the illustrations show, notable works have been undertaken for the development of Austria's water power with a view to making her economically independent of foreign coal, despite the difficult financial situation. The statistics are carried through 1929. The bibliography covers nine pages; 264 hydro-electric plants, including those of industrial concerns are listed.

Men of the Industry

W. J. Baldwin Assumes New Duties in South

W. J. BALDWIN, formerly publicity director of the Alabama Power Company, has taken up his new duties as director of publicity and advertising adviser of the Southern group of the Commonwealth & Southern Corporation of New York. Mr. Baldwin will continue his office at the Alabama Power Company building in Birmingham, Ala., Southern headquarters of Commonwealth & Southern. He will still exercise general supervision over publicity of the Alabama Power Company, a subsidiary company, but will be relieved of details of the work, which duty has been assigned to Robert H. Mangum, as director of publicity, who prior to the change, effective July 1, was assistant manager of the investment department. Mr. Baldwin has spent most of his life in utility work. For quite a while he was assistant to the general manager of the New Orleans Power & Light Corporation. He is widely acquainted with newspaper and advertising men of the South. In his new connection he will spend considerable time in his territory, which includes several Southern states.

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W. H. HASSINGER of Birmingham, Ala., has been elected a director of the Commonwealth & Southern Corporation.

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M. M. FISHER, treasurer of the Willapa Electric Company, Aberdeen, Wash., has been appointed assistant to the manager of that company. John M. Weir has been named superintendent.

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E. G. DUNLAP, treasurer of the Ohio Edison Company, recently formed through the merger of several Ohio companies, will remove from Youngstown to Akron, new headquarters. Others to be transferred to Akron are H. N. Wood, commercial manager, and H. B. Lingeman, general purchasing agent. The Ohio Edison, which is a subsidiary of the Commonwealth & Southern, is understood to be planning acquisition of other utilities in Ohio.

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ERNEST JOHNSON has been appointed assistant auditor of the central division of the Niagara Hudson Power system. Mr. Johnson has been secretary and treasurer of the North Syracuse Light & Power Company, the Mexico Company and the Seneca River Power Company and in 1928 became secretary and assistant treasurer of the Syracuse Lighting Company. He has been in the public utility field since 1895, when he started in St. Augustine, Fla. He removed to Allentown in 1906 and to Syracuse two years later.

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DR. WILLIAM A. SHEWHART, of the technical staff of the Bell Telephone Laboratories, Inc., will give a special course at Stevens Institute of Technology as a part of the new program of graduate instruction in the college. The course will deal with the theory of statistics, the application of modern statistical theory to the analysis, interpretation and presentation of data, to the planning of physical investigations, to the development of economical production and inspection methods and to the establishment of standards for quality. Doctor Shewhart is a recognized authority on modern statistical theory and has been for some years engaged in research in this field. He has published several papers on this subject and has just completed a text which will be issued in the fall. Doctor Shewhart's course is scheduled to begin September 23, 1930.

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Buffalo, Niagara & Eastern Elects New Vice-Presidents

CHARLES A. TATTERSALL and WILLIAM L. COLLINS, formerly assistant vice-presidents of the Buffalo, Niagara & Eastern Power Corporation, have been named vice-presidents of that organization.

C. A. Tattersall

Mr. Tattersall has been connected with the company and its predecessors for 22 years, starting as an employee of the Niagara Falls Power Company. He advanced gradually in the ranks and was made assistant to the manager of the land, taxes and insurance department in 1916. Three years later he became assistant to the vice-president and general manager and six years later assistant to the president. He was elected assistant vice-president of the Buffalo, Niagara & Eastern last year. He is a member of the Buffalo Chamber of Commerce, vice-president and a director of the Electrical League of the Niagara Frontier and vice-president and a director of Niagara Gorge Railroad Company.

Mr. Collins has been in the power industry for 25 years, starting as a clerk with the Niagara, Lockport & Ontario Power Company. After serving in various capacities he was appointed purchasing agent. He was elected vice-president of Niagara, Lockport & Ontario in 1927 and in addition was elected assistant vice-president of Buffalo, Niagara & Eastern last year.

W. A. Collins

Mr. Collins is treasurer and a director of the Utilities Mutual Insurance Company, secretary and treasurer of Niagara Electric Improvement Company, and president of the Hydraulic Race Company.

C. B. Burleigh Retires

CHARLES B. BURLEIGH, for many years manager of the central-station department of the New England district of the General Electric Company, retired September 1 from active service. He entered the employ of the Thomson-

Houston Electric Company in 1884 as erecting engineer, after serving in the Bell telephone organization in the Minnesota-Dakota area on construction work, building telegraph lines in the Indian country and installing lighting plants in the Washburn, Humboldt and Zenith Mills at Minneapolis. For a short time he was associated with the Sawyer Mann Electric Company.

Mr. Burleigh's career with the General Electric Company at Boston has been intimately associated with the development of the power industry in the New England states. He is one of the most widely known sales engineers in the northeast, and aside from his commercial activities has devoted much time to personnel problems and civic affairs. At the close of the World War he organized a committee at Boston which re-established about 4,000 returned service men in industry and commerce. As dean of New England electrical salesmen he has won the regard of a host of friends in every branch of the industry. Mr. Burleigh is a fellow of the American Institute of Electrical Engineers and a member of many business and professional organizations.

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C. C. CHILDERS, president of Childers Electric & Paint Company, was recently elected an honorary life member of the Electrical Clearing House of Louisville, Ky., in recognition of his valuable service to the organization, of which he is a charter member. He helped organize the clearing house eighteen years ago and was its first president, serving from 1912 to 1924. His election to life membership was by unanimous vote and was the first time the clearing house ever conferred such an honor.

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F. O. Schnure Heads Iron and Steel Engineers

FRED O. SCHNURE, electrical superintendent of the Bethlehem Steel Company at Sparrows Point, Md., has been elected president of the Association of Iron and Steel Electrical Engineers. A native of New Jersey, Mr. Schnure received his technical education at Bucknell University, from which institution he was graduated with the degree of electrical engineer.

From 1914 to 1916 he was identified with the New York Railways, D. C. and W. B. Jackson, engineers, and with the Pennsylvania Railroad. It was in 1916 that he affiliated himself with the Bethlehem Steel Company as draftman, subsequently becoming foreman and later serving successively as general foreman, assistant electrical superintendent and since 1923 as electrical superintendent.

Mr. Schnure has been active in the Association of Iron and Steel Electrical Engineers for some years. He served

as chairman of the Philadelphia section in 1926-1927 and as a member of various committees. In addition, he is a member of the American Institute of Electrical Engineers and has been on the executive committee of the Baltimore section since 1927. He served as a member of the educational committee of the Baltimore Chamber of Commerce during the years 1928-1929. Mr. Schnure has frequently contributed papers to the meetings of these associations and to the technical press on a variety of subjects dealing with the application of electricity to the steel industry.

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OBITUARY

PROF. FRANCESCO GRASSI, Italian electrical engineer, died recently in Milan at the age of 78. Professor Grassi was one of the Italian delegates to the International Electrotechnical Congress in Chicago in 1893.

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WALTER H. VORCE, electrical engineer of Rochester, N. Y., died suddenly in a Laconia, N. H., hospital on August 25, after a brief illness. He was on a vacation at Short Hills when stricken. Mr. Vorce was a graduate of the Massachusetts Institute of Technology. He was born in Farrington, Conn.

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ISADORE STERNEFELD, special representative of the Westinghouse Electric International Company, died August 21 at the American Hospital, Paris, France, as a result of injuries sustained in an accident the previous day. Mr. Sternefeld had been associated with Westinghouse Electric interests for 36 years, his activities having been always in the foreign field. He was born in Alsace-Lorraine and retained his French citizenship throughout his life. He studied engineering and military science in Paris, and served as an officer in the Corps of Engineers in the French Army in Morocco and in the Franco-Prussian War. Mr. Sternefeld removed to the United States in the early '90s and became associated with the Westinghouse company in 1894, when he was assigned to represent that company in Mexico during the régime of President Diaz. He played a significant part in the development of many of Mexico's electric power generation projects, and when he left that country, twenty years later, he left many friends high in diplomatic and engineering circles. In the service of the Westinghouse company he traveled over the greater part of the civilized world, residing for some time in Venezuela, Brazil, Shanghai, London, and Paris. For the past few years Mr. Sternefeld had been acting as special representative, first in London and later in Paris, where he was living at the time of his death. Owing to his advancing years, his services were called upon recently only in special cases where his wide and matured experience was found necessary.

Financial and Statistical News

PREDICTIONS of tighter money after Labor Day, a condition which usually exists, have not yet been borne out. Call money remained at 2 per cent in New York and has been offered outside as low as 1½ per cent.

——The securities markets continue to await a more definite business trend. While higher steel ingot production and car loadings are in the right direction, more specific indications of improvement are awaited.

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Pacific Gas & Electric Earns $1.20 on Common

A STATEMENT ISSUED BY THE Pacific Gas & Electric Company shows net earnings for the six months ended June 30 amounting to $6,530,432, after charges but before accrued dividends on common stock, equivalent to $1.60 a share on the average of 4,082,947 common shares outstanding during the first half of the year. As compared with the first six months of 1929, this shows an increase in net profit of $721,084.

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July Revenue Exceeds Last Year's

JULY REVENUE OF ELECTRIC LIGHT and power companies was 2.5 to 3 per cent greater this year than last, according to an analysis of present returns. Accounting for about a third of the industry, these show an increase for the reporting companies of 2.2 per cent. This will probably be somewhat improved when important companies, now missing, are included; the month's total revenue for the whole country is estimated approximately at $167,000,000, compared with $162,300,000 a year ago and $149,400,000 in 1928. The small decrease from $170,400,000 for June is seasonal.

This continues the record thus far made, each month of 1930 showing a revenue in excess of the corresponding figure for 1929. July energy sales were down about 2 per cent; this still leaves them 11 per cent larger than in 1928. The influence of reduced industrial energy consumption is evident; the healthy growth in residential consumption is in marked contrast.

In view of prevailing conditions the Atlantic and Pacific seaboard states made a remarkably good showing, with regional revenue gains around 4 or 5 per cent. New England is an exception; some localities fell off decidedly, but the section as a whole shows a gain that will not be far from 1 per cent.

The East North Central section continues to be the country's low spot, with a decrease of revenue that may be tentatively taken at 5 per cent compared with July, 1929. The June returns for this section showed an increase of 1 per cent.

Throughout the country the returns indicate considerable local variations, neighboring companies often reporting contrary movements, some downward and others satisfactorily upward.

Public Utility Bonds Called in September

AMONG THE SECURITIES CALLED for payment in the month of September in advance of maturity the following public utility bonds appeared: Kansas Gas & Electric first 6s, 1952, amounting to $14,000,000; Penn-Ohio Power & Light debenture 6s, 1939, amounting to $2,700,000; Northern Ohio Traction & Light 6½s, 1941, amounting to $2,264,500; Southern Ohio Public Service C 5½s, 1957, amounting to $2,228,000; Pacific Public Service 6s, 1944, amounting to $1,635,000. These all represented entire issues. The following securities were called, the issues not being in entirety: Provincial Light, Heat & Power 5s, 1946, totaling $42,000; Toho Electric Power 7s, 1955, amounting to $275,000, and the Ujigawa Electric Power 7s, 1945, amounting to $140,000.

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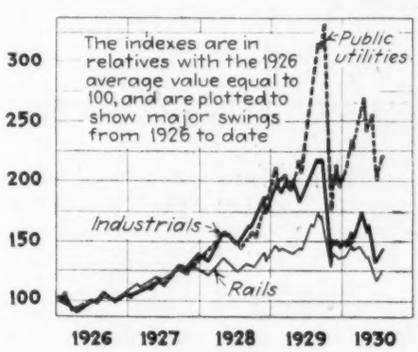
Have We Still a Utility Market?

WHILE utility stocks still keep their substantial lead in market valuation over other groups, brokers are discussing the question of whether or not the present relative positions are more or less permanent.

The positions of these groups during the last bull market are clearly illustrated by the accompanying chart, based on figures compiled by Standard Statistics Company, Inc. A study of the chart shows that while all groups fluctuated more or less on the same level until about the middle of 1927, the utilities and industrials took an up turn from that time until the market break last November. The utilities, moreover, left the industrial group behind early in 1929 as the greatest utility market on record developed.



Utilities led all groups in last bull market

During 1930 to date the fluctuations of all groups have been on approximately parallel lines, with the utilities far in the lead. According to a recent compilation a representative utility group averaged more than seventeen times earnings, the rails averaged fourteen times earnings and the industrials 11.3 times earnings.

Whether or not the market will continue to evaluate the stocks in these respective group relationships depends on future events. It was anticipated some time ago that federal investigation and later rate case arguments would force the utilities down nearer the position of industrials. The exceedingly satisfactory showing made by the utilities during the business depression, however, has reassured the investing public, and, according to present indications, the utilities are likely to hold their lead. In fact, they are likely to be less affected during the months of recovery than any other group.

Bond Financing Program for Autumn Substantial

WHETHER or not the general swing back to bond financing, predicted in various quarters after the market panic, is now likely to materialize is again being actively discussed. Bond financing is not yet reaching the volume to be anticipated on the basis of previous low money rate periods. Last month, in fact, its volume was exceeded by the total of stock financing. On the other hand, a big program of new bond financing is now being set up by the bankers for the balance of the year. The utilities figure prominently in these plans.

Activity in the bond market of late has been confined almost entirely to highest grade bonds. Second grade issues have not shared in the market advance to any extent, and in fact some issues have lost ground. Bond financing does not, therefore, commend itself at the moment to the type of company whose bonds would be classified lower than high grade. Generally reduced earnings resulting from the recession in business makes it still more difficult, especially for smaller industrial concerns, to sell their bonds at an attractive price. Furthermore, it seems probable that the public demand for stocks which was so greatly enhanced during the last bull market has been merely interrupted rather than discontinued.

Large program in prospect

As already stated, however, a large list of new bond issues is being shaped for the coming months. In the utility field it is understood that Alabama Power Company, Georgia Power Company, Iowa-Nebraska Light & Power Company, Pennsylvania Power & Light Company and State Line Generating Company have issues in prospect which will reach a combined total well in excess of $100,000,000. The specific issues referred to in press comment as being in prospect are a $15,000,000 issue of the Alabama Power Company first 4½s of 1967, an issue of Georgia Power Company first 5s of 1967, a $10,000,000 issue of Iowa-Nebraska Light & Power Company first 5s, an issue of $50,000,000 Pennsylvania Power & Light Company first 4½s of 1960, an issue of State Line Generating Company first 4½s, totaling $17,000,000, and an issue of 5½ per cent debentures of the same company amounting to $8,000,000.

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New Holding Company Organized

THE POWER, LIGHT & SERVICE COMPANY has been incorporated in Delaware as a public utility holding company with an authorized capital of debentures totaling $25,000,000, preferred stock numbering 200,000 shares and 1,000,000 shares of common stock. As an initial step in the formation of the company, the American Service Company has been acquired by the group, which already owns the Western Power, Light & Telephone Company. Nathan L. Jones of Salina, Kan., who is president of both the Western Power and of the American Service, will be president and general manager of the new company. Other officers are Hamilton Allport, D. G. Wagner and Arthur L. Mullergren, vice-presidents; Shirley Stewart, secretary; M. K. Kennedy, treasurer; P. W. Fisher and P. D. Stokes, assistant treasurers, and P. D. Stokes, assistant secretary.

The Western Power, Light & Telephone Company owns properties operating in Missouri, Kansas, Oklahoma, Texas, Iowa, Nebraska and Colorado. The American Service Company has properties in Texas, Louisiana, Alabama, Kansas, Iowa, Missouri, Tennessee, Georgia, North Carolina, Oklahoma and West Virginia.

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Earnings Statements Show Effects of Depression

THE AIR-WAY ELECTRIC APPLIANCE Corporation, Toledo, Ohio, earned net profits of $511,173 in the first six months of this year after depreciation, taxes and other charges, equal after deferred dividends to $1.10 a share on the 400,000 shares of common stock outstanding. This compares with a net of $889,903, or $2.05 a share, in the corresponding period of 1929.

Apex Electrical Manufacturing Company reports for six months ended June 30 net profit of $163,269 after charges, depreciation and federal taxes, equivalent, after allowing for dividends on 9,600 shares of 7 per cent preferred stock, to $1.47 a share on 87,680 no-par shares of common stock. This compares with $122,176, or $1.01 a common share, on above share basis, in first half of 1929.

Weston Electrical Instrument Corporation reports for six months ended June 30 net profit of $448,884 after depreciation, federal taxes, etc., equivalent, under the participating provisions of the shares, to $2.65 a share on 50,000 no-par shares of class A stock and $2.15 a share on 146,600 shares of no-par common stock. This compares with $461,922, or $2.49 a share, on 65,000 shares of class A and $1.99 a share on 150,000 shares of common stock in first half of 1929.

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CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

	1930	1929	Per Cent Increase	Operating Ratio 1930	Operating Ratio 1929
Alabama Power* (Year ended July 31)					
Gross earnings	$18,111,074	$17,959,822	0.8	42	37
Net earnings	10,469,433	11,365,296	— 7.9	..	..
American Commonwealths Power & affiliated Cos. (Year ended July 31)					
Gross earnings	20,606,819	27,444,259	—24.8	58	54
Net earnings	8,621,508	12,693,295	—32.2	..	..
Associated Gas & Electric (Year ended July 31)					
Gross earnings	108,050,904	65,784,842	64.0	50	54
Net earnings	53,670,010	30,324,546	77.0	..	..
Commonwealth & Southern (Year ended July 31)					
Gross earnings	146,219,204	144,328,164	1.3	49	49
Net earnings	74,520,524	73,654,367	1.2	..	..
Consumers Power (Year ended July 31)					
Gross earnings	33,134,787	32,690,219	1.4	47	50
Net earnings	17,431,483	16,547,455	5.3	..	..

*1929 figures include properties sold May 1, 1929.

	1930	1929	Per Cent Increase	Operating Ratio 1930	Operating Ratio 1929
Kansas City Power & Light (Year ended July 31)					
Gross earnings	14,664,415	14,301,637	2.5	50	51
Net earnings	7,437,103	7,024,494	5.9	..	..
National Power & Light Subsidiary Cos. (Year ended June 30)					
Gross earnings	81,130,401	80,560,029	0.7	55	55
Net earnings	36,505,393	35,979,816	1.5	..	..
Nevada-California Electric & subs. (Year ended July 31)					
Gross earnings	5,624,920	5,563,998	1.1	49	47
Net earnings	2,855,513	2,960,400	— 3.5	..	..
Southern California Edison (Year ended July 31)					
Gross earnings	40,997,872	37,787,551	8.0	33	34
Net earnings	27,295,991	24,811,418	10.0	..	..
Tennessee Electric Power (Year ended July 31)					
Gross earnings	15,328,654	14,034,053	9.2	51	51
Net earnings	7,483,817	6,879,638	8.8	..	..

Portland Utility Makes $40,000,000 Offering

PORTLAND GENERAL ELECTRIC COMPANY, the organization of which was previously announced in the ELECTRICAL WORLD, has issued first and refunding mortgage gold bonds to the amount of $40,000,000 at 93¾ and interest, yielding 4.90 per cent. These 30-year 4½ per cent bonds, upon redemption of outstanding bonds to be called or prior discharge of mortgages securing the same, will be secured by a direct first mortgage on the major portion of the fixed properties to be owned by the company and will be further secured by a direct mortgage on the remainder of its fixed properties, subject only to $6,813,000 of underlying bonds. Proceeds will be used to retire approximately $29,000,000 principal amount of 5, 5½, 6 and 7½ per cent mortgage debt now outstanding against the properties to be owned by the company, to refund advances for the installation of additional generating capacity, to provide the company with working capital.

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Roumanian Plants Comprise 254,395 Kw.

A SUMMARY OF DATA CONTAINED in the compilation published in Sibiu by the Electric Power Plant Association of Roumania, under the title "Statistics of Roumanian Electric Power Plants," gives the following totals for the year 1929:

Public Utility Plants

Number of plants	157
Number of communities served	267
Generator rating, kw.	169,650
Prime movers, hp.	234,186
Diesel, hp.	54,399
Hydro, hp.	11,446
Lighting customers	238,879
Connected motor load, kw.	60,866
Output, kw.-hr.	285,021,266
Lighting voltage, predominant	220
Frequencies, largely 50 cycles but also much 42 cycles.	

Industrial Plants

Number of plants	18
Generator rating, kw.	84,745
Output, kw.-hr.	207,095,101

The largest public utility plant is one of 34,600 kw., at Bucharest. The largest private plant, of 23,000 kw., appears to be used in connection with the nitrogen industry; its annual use-factor, however, is only 36 per cent.

In the publication mentioned, the data for individual establishments are reported in unusual detail; to the extent of 82 items for each one. The column headings are in five languages, one of them English, so that the American reader whose knowledge of Roumania is not entirely fluent need anticipate no embarrassment. The price, 350 lei, may suggest the need of storing the volume in a vault when not in use; this difficulty, too, disappears after looking up the current rate of exchange, for the American equivalent is about $2.10.

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Power Securities Extends Stock Exchange Period

THE TIME WITHIN WHICH second preferred stock and common stock of Power Securities Corporation may be deposited for proposed exchange for $6 preferred stock of Electric Power & Light Corporation, under the respective plans and agreements entered into with Nanticoke Securities Corporation and Schuylkill Securities Corporation by certain holders of such second preferred stock and common stock, has been extended from the close of business on August 30, 1930, to the close of business on September 30, 1930. These extensions have been made at the request of various holders of stock of Power Securities Corporation who have been unable to deposit their stock within the time originally fixed.

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August Issues Total Only $22,446,334

NEW OFFERINGS OF ELECTRIC light and power securities amounted to only $22,446,334 in the month of August, the smallest total on record since July, 1928, with the exception of last November, when the utility companies did not enter the market at all for funds. August is always a dull month. Last year, when monthly totals ranged from $65,000,000 to $175,000,000, August showed a total of only $31,000,000. And aside from seasonal considerations new financing at present is on a substantially reduced scale. Only four companies took part in the financing last month and not a single offering reached $10,000,000. The average yield amounted to 5.40 per cent.

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NEWS BRIEFS

Operating subsidiaries of the Central Public Service Corporation sold customers in their territories merchandise and appliances valued at $2,476,442 in the first seven months of 1930. These sales, which are net after deduction of all returns and allowances, represent an increase of 9.9 per cent over the total of $2,252,180 in the similar period of 1929.

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Board of directors of the Middle West Utilities Company has voted to extend the period during which the outstanding common stock purchase warrants, series A, 1930, and common stock purchase warrants, series B, 1931, may be exercised. Series A warrants, which entitle the holder to purchase common stock of the company at $40 per share until December 31, 1930, may now be exercised until December 31, 1931, at which time they will become void and of no effect. Series B warrants, which entitle the holder to purchase common stock of the company at $45 per share from January 1, 1931, to December 31, 1931, may now be exercised from January 1, 1931, until December 31, 1932, at which time they will become void.

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Coast Counties Gas & Electric Company has called for redemption all of its outstanding first mortgage 5 per cent bonds due August 1, 1946, at 107½ and interest.

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Foshay Bond Interest

THE PAYMENT OF INTEREST on bonds of Public Utilities Consolidated Corporation, a W. B. Foshay property now in receivership, has been authorized by Federal Judge Joseph W. Molyneaux. Application was made by the receiver, Joseph Chapman. Payments will amount to $209,203 on the first and junior mortgage bonds due September 1 and $57,797 semi-annual interest October 1 on the first mortgage bonds.

New Security Issues of Electric Service Companies in August

Name of Company	Amount	Period (Years)	Class	Purpose	Interest Rate	Price	Per Cent Yield
Eastern New Jersey Power Co.	$3,140,000	29	First mortgage gold bonds	To reimburse the company, in part, for additions, extensions and improvements to its properties	5	100	5
Indianapolis Power & Light Co.	8,000,000	27	First mortgage gold bonds, series A	To reimburse the company for capital heretofore expended, to pay for the cost of the power plant now under construction and for other corporate purposes	5	100	5
Commonwealth & Southern Corp.	9,956,334	..	Preferred stock		6	100½	5.95
United Ohio Utilities Co.	1,350,000	..	Prior preferred stock		6	98½	6.09
Total	22,446,334			Rights			
Total amount actually realized	22,475,865			Total financing for August	22,475,865		

Business News and Markets

STEEL production presents one of the few favorable news items of the week. Ingot output rose for the third consecutive week. Building contracts also rose slightly and industrial production shows a slight upward trend.

——THE COPPER MARKET CONTINUES UNSATISFACTORY with a tendency toward continued price weakness.

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Sale of Appliances Up 8.8 per Cent

SALES OF ELECTRICAL APPLIANCES for the first half year were greater than in the same period last year despite the general business depression.

Reports of the principal electric light and power companies to *Electrical Merchandising* indicate gains made in the entire appliance field. These reveal a total sales increase of 8.8 per cent over the same period in 1929. The utility companies do about one-third of the total appliance business.

In view of general conditions, the fact that chief gains were made by the more expensive appliances is somewhat of a surprise. The smaller appliances do not hold up so well. Refrigerators showed a 6 per cent increase; ranges, 45 per cent. Growing popularity of the ironer is indicated by a 34 per cent increase, and washers 10 per cent. Vacuum cleaners alone, of the major appliances, showed a falling off of 4 per cent.

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Supervisory Control and Equipment Orders Let

THE STEADILY INCREASING TREND to supervisory control for centralized remote control of electrical power apparatus is reflected by two large orders recently received by the Westinghouse Electric & Manufacturing Company for "Visicode" type supervisory control equipment. These orders cover a total of 25 "Visicode" equipments, five having been purchased by the Long Island Railroad Company and 20 by the Reading Company. In addition, both of these orders include the switchboards for the main stations involved.

The "Visicode" provides a means for remotely controlling and supervising a large variety of power apparatus. It is outstanding in that it provides remote control with continuous individual visual lamp indications for each piece of remotely controlled apparatus, and all over only two telephone type line wires. Where a number of the stations are in the same general direction from the dispatching point, such as on the orders just secured, these stations are arranged to operate over the same pair of line wires.

The Reading Company order covers equipment for the initial railway electrification of its Philadelphia suburban area. Seven power substations and fourteen intermediate stations in this area, which will supply current to the electrified zone of the railroad, will be entirely unattended and will be operated from a central point located in the load dispatcher's office at Wayne Junction, by means of the "Visicode" type of supervisory control.

The Long Island Railroad Company order covers "Visicode" type of supervisory control for five substations. Four of these stations will contain mercury-arc rectifiers, which will be controlled by means of automatic switching equipment included on this same order.

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Some Suggestions for Selling Home Lighting*

By J. H. BLITZER
Vice-President Lightolier Company

IN EACH central-station office, or assigned to a group of central-station offices, there should be maintained a trained illuminating engineer to give expert advice on better lighting. Among the duties of this illuminating engineer should be frequent addresses to women's clubs, home economics organizations and schools and gatherings of one kind and another. In this manner the precepts of good home lighting should reach several thousand people annually, and the lessons which they learn will in each case be transmitted to an ever-widening circle of family and friends. From these talks, from these contacts, and from the publicity naturally created through such gatherings, there comes about an inevitable lighting consciousness in a community which can hardly be created by any other method.

It is my personal observation that display facilities of the average central-station offices are utilized to but 20 per cent of what should be full efficiency. Virtually all central-station offices are on main streets or important highways. Too many of them are conspicuous by the absence of appealing merchandise in their windows and in their office room. I submit that this main-street space should display samples of better lighting equipment and that these samples should be kept lighted at night for as long a time as people generally pass those windows. It stands to reason that the consumers who come to pay their bills are, in those moments in which they are in the central-station office, thinking of lighting and thinking of the uses to which their electrical energy can be put. There is no time more opportune to show them the latest developments of the electrical industry.

Almost every central station has a newspaper advertising budget. Without attempting to pose as an advertising expert, it is my opinion that much of this space is filled merely because the contract to fill it is in the newspaper's office. It is also my observation that too many central-station men believe that advertising in itself can generate that mysterious but powerful element called "good will." I venture to differ.

**From an address before Camp Co-operation X, under the auspices of the League Council and the Society for Electrical Development, Inc.*

Gentlemen, you can talk about good will till the cows come home. It is an intangible, vague, indefinite and worthless thing unless you have done something to deserve it. Good will is appreciation for services rendered—or it is nothing. Newspaper advertising can certainly help render that service by informing the readers of the newspaper that in good lighting they enjoy the world's most economical luxury and by showing consumers how to take greater advantage of the decorative, comfort-building and health-promoting aspects of sound lighting.

Publicity through direct mail

There's another avenue for publicity and for education in which most central stations are conspicuous by their lost opportunities rather than their effective efforts—and I refer, of course, to the use of direct mail, such as envelope inclosures, booklets, folders and similar materials. I believe it is true that practically all central stations now do at least some of this work, but I submit that no type of business in this country is so favorably situated to do a great deal more direct mail advertising on an economical basis. For one thing, central stations have a perfect mailing list—their customers—and for another thing they have twelve regular mailings in the course of each year, when they send out their monthly bills, so that twelve times annually there is room to bring some important message before their customers without even additional postage expense. At least two or three times during the year the inclosure or the folder or the booklet should be a well-prepared message on home lighting, either featuring a display of especially stylish goods in the showrooms of the central station or discussing ideal illumination for some single room in the house, such as the living room or the nursery or even the basement.

While there should be a consistent program running through all the months of the year on home lighting, it is also advisable for sound merchandising reasons to select the most favorable period for an especial drive and for additional emphasis. In the case of home lighting that period is in the fall months of the year, since then lighting is more required and more in use, since at that time a great many homes are being redecorated for winter social affairs, and since the lighting obstacle of daylight saving is by then out of the way. At this season of the year, therefore, the illuminating engineer should be especially busy, the fixture displays of the central station should be particularly replete with up-to-date numbers, the newspaper advertising should feature home lighting, and the direct mail inclosures with monthly bills should dwell on the same topic.

TRADE BRIEFS

Reliance Electric & Engineering Company, Cleveland, Ohio, announces that James S. Fenton has been promoted to the position of sales engineer of the New York office.

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The Electric Machinery Manufacturing Company, Minneapolis, Minn., of which C. F. Henderson, Call Building, San Francisco, Calif., is district representative, recently sold to the Shell Chemical Company, a subsidiary of the Shell Oil Company of San Francisco, the motors and control equipment for its new $3,000,000 plant.

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Murray Iron Works Company, Burlington, Iowa, manufacturer of steam turbines, engines and boilers, has appointed two new agencies: Wm. Stairs, Son & Morrow, Ltd., Halifax, N. S., and Mathews & Company, 734 Brookhaven Drive, Orlando, Fla.

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Network Protector Order

MADISON GAS & ELECTRIC COMPANY has ordered thirteen 1,200-amp. network protectors from the Westinghouse Electric & Manufacturing Company. Nine of them are of the submersible type and the other four of the open type. This order has a value of approximately $18,000 and represents the largest order yet placed by the Madison Gas & Electric Company for a.-c. network protectors. The previous network protectors purchased by this customer were used as more or less of an experimental installation. Since the low voltage a.-c. network system has proved itself, preparations are being made for expansion, as evidenced by this order.

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Better Export Demand for Copper

ASIDE FROM A MODERATE improvement in export demand, the copper situation underwent scarcely any change in the last week. Domestic buyers are satisfied to sit back for the present to see how business will act under the stimulus of fall buying. They are fairly well covered against their September-October requirements and unless business picks up materially some of the fabricators have enough copper purchased to carry them through November. The

	Aug. 27, 1930 Cents per Pound	Sept. 3, 1930 Cents per Pound
Copper, electrolytic	10⅜	10⅜–11
Lead, Am. S. & R. price	5⅛	5⅛
Antimony	7¾	7¾
Nickel, ingot	35	35
Zinc, spots	4.65	4.65
Tin, straits	30	29⅞
Aluminum, 99 per cent	23.30	23.30

August statistics are expected to show an increase in stocks of refined metal, which is being used as a bearish argument by prospective buyers.

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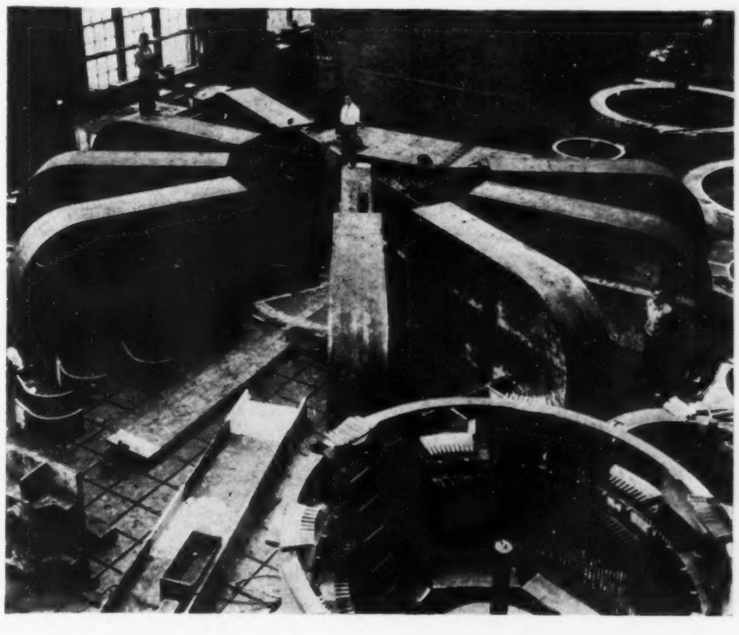
BUILDING GIANT POWER UNIT FOR DNEIPER RIVER



The big thrust-bearing bracket of an 84,000-hp. water-driven unit under construction at the Schenectady, N. Y., works of the General Electric Company for the Dneiper River power station in Russia.

Market Conditions

DEFINITE signs of improved buying by industrial concerns are noted in the Eastern district this week. Utility business is still at a low ebb. Elsewhere volume is still below that of last year. Early August gains in the Pacific area were not sustained, although the outlook for fall business is good.

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PACIFIC COAST

—FAILING TO HOLD *its early August gains, business relapsed again and careful observers failed to see any immediate encouragement. Railroad buying is limited to actual maintenance, installation crews having had little work for six months past, and expecting none until 1931. The outstanding railroad order covers a carload of dry batteries.*

—POWER COMPANY PURCHASING *shows a normal demand for distributing transformers, a better call for meters, but no spectacular sales or prospects. Motor sales are poor because industrials are buying from hand to mouth.*

The only special machinery sale reported this past week amounted to $5,000 and covers the conversion to standardized equipment of battery locomotives for San Francisco's Hetch-Hetchy project. Contractors find a fair amount of minor construction and relighting. The miniature golf craze is moving indoors, where higher rent and furnishing charges are cutting the lighting expenditure. Portland continues to lead San Francisco, Seattle, and Los Angeles, respectively, in smallness of decrease of electrical business in 1930 over 1929, the rate ranging from minus 2 per cent for Portland to minus 15 per cent for Los Angeles. The power bond proposal providing for San Francisco's purchase at an eventual price of $85,000,000 of the private companies serving her was beaten by a 3 to 1 vote. Government buying is a bright spot in coast electrical business, covering such items as 2,500 small portable lamps for Mare Island, 110 electric refrigerators for San Diego, new barracks and buildings for Fort Mason, Veterans' Hospital at Palo Alto, Letterman Hospital and Marchfield, a $600,000 submarine base for Mare Island, and a 35-standard $5,000 lighting job for Fort Mason in San Francisco. The outstanding inquiry of the week covers approximately 70,000 ft. of 750,000-circ.mil. 11,000-volt triplex sector cable.

In the Puget Sound district and northwest, 350 lumber mills, continuing on the low-production schedule followed since May, operated last week at 46.7 per cent of capacity and buying of motors and electrical apparatus from this source is practically at a standstill. Sales reported included a carload of Moloney distribution transformers ranging from 5 to 200 kva. to Rainier National Park, twenty motors from 25 hp. down to dealers, eighteen machines from 50 hp. down to irrigation and miscellaneous sources, one 135-kva. alternator to a power company and one small motor-generator set to an industrial plant. City of Seattle is taking bids until September 12 for three 60-kw. exciters and regulators costing about $17,000 and city of Spokane for a 500-hp. pumping unit and a 2,700-gal. pump costing about $12,000. Pacific Coast Paper Mills, Bellingham, are planning a $500,000 addition to existing plant; Howard Flat irrigation district at Chelan is making plans for a $300,000 project; Kellogg, Idaho, plans street lighting for business district, and federal power commission has authorized construction of a 283,000-hp. hydro-electric project on Klamath River in Oregon by California-Oregon Power Company.

CONSTRUCTION PROJECTS

Southern California Edison Company, Los Angeles, Calif., will build a power substation. Los Angeles, Santa Cruz and Glendale, Calif., plan ornamental lighting systems. California-Oregon Power Company, Medford, Ore., has permit for a hydro-electric power plant on Klamath River, Ore., to cost $5,000,000. Puget Sound Power & Light Company, Seattle, Wash., plans power substation at Bellingham, Wash. Portland Canal Power Company, Seattle, Wash., plans hydro-electric power plant near Hyder, Alaska, to cost $3,000,000.

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SOUTHEAST

—THE VOLUME OF ORDERS *placed in the Southeast for the past week were considerably below the average for previous weeks.*

One Alabama mill is reported to have placed orders for approximately $10,000 in construction material and one Georgia mill announces it will completely revamp its plant, but no report has as yet been made of any orders being placed. A sale of 35 distribution transformers was reported in Alabama. A Southeastern utility purchased switches to the amount of $1,150, poles to the amount of $1,200, transformers to the amount of $3,150, copper wire to the amount of $7,000, meters to the amount of $2,000 and miscellaneous materials to the amount of $950.

CONSTRUCTION PROJECTS

Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until September 9 for one motor-driven air compressor at Hampton Roads, Va. (Schedule 4010). Island Improvement Association, Wheeling, W. Va., will receive bids until September 15 for an ornamental lighting system. Memphis Power & Light Company, Memphis, Tenn., plans power plant to cost over $1,000,000. Georgia Power Company, Atlanta, Ga., plans extensions in transmission lines to Woodbine, White Oak and vicinity. Tampa Shipbuilding & Engineering Company, Tampa, Fla., plans an expansion program to cost over $200,000.

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MIDDLE WEST

—THE SLIGHT ACCELERATION *in general business observed last week continued this week in the Middle West section. While considerable spottiness still exists, indications of improving business conditions are noticeable.*

Increased production in the steel industry is looked upon as an extremely favorable indication. Increased employment, car loadings and automotive production are others, while retail trade has made some recovery. More construction is being started and industrial activity is improving. The various utility companies are preparing for a normal fall business and plans for expansion, curtailed for some months, are being put into work. The demand for apparatus has been somewhat light, although maintenance purchases are increasing.

Jobbers' sales have improved a trifle. While railroad business is somewhat light, increased industrial activity is being reflected in a larger volume of sales. Considerable business is coming in from the coal mining section in southern Illinois. There has been a fair demand for most appliances, while an increased demand is noted for electric washing machines.

CONSTRUCTION PROJECTS

Madison, Wis., plans call for bids in October for an ornamental lighting system. American Black Granite Company, Mellen, Wis., plans extensions and improvements in quarry to cost about $100,000. Public Service Company of Northern Illinois, Chicago, Ill., will build an equipment storage and distributing plant at Glencoe, Ill., to cost $350,000. Illinois Steel Company, Chicago, Ill., has filed plans for a mill unit to cost $1,500,000. Detroit Yacht Harbor, Inc., Detroit, Mich.,

plans boat harbor buildings and repair plant to cost over $1,000,000. Terminal Warehouse Company, Pontiac, Mich., plans plant to cost $350,000. State Department of Public Welfare, Columbus, Ohio, will take bids for a power plant at Cincinnati, Ohio, to cost $240,000. Republic Steel Corporation, Warren, Ohio, will build an addition to cost $1,500,000. John Carroll University, Cleveland, Ohio, plans power plant to cost $60,000. Board of Park Commissioners, Minneapolis, Minn., plans equipment storage and distributing plant to cost $100,000. Southern Nebraska Power Company, Abilene, Kan., plans power plant at Clay Center, Neb.

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EASTERN

—INDUSTRIAL ACCOUNT SHOWS INCREASING *proportions in the electrical equipment market in the Eastern district, not only with respect to actual commitments but in connection with inquiries, which seem to carry definite indications of a revival in buying in this line. Central station demand is light for the opening of the fall season and orders are limited to actual requirements in the line of substation and miscellaneous apparatus.*

—ELECTRIC REFRIGERATOR BUSINESS *is reaching new high records both for production and sales, with an outlook most favorable for continuance. Jobbers report little change in their trade for electrical supplies and hand-to-mouth buying prevails.*

A steel company in northern New York has placed an order with a state manufacturer for electrical control equipment totaling $35,000. Three other iron and steel companies have arranged immediate expansion programs to cost over $5,000,000, a considerable portion of the fund to be used for purchase of electrical equipment for heavy duty. An aircraft manufacturing company in New Jersey has closed with a New York maker for impellers for superchargers for aircraft to cost about $35,000.

Fall account for railway electrification work looks promising. The Pennsylvania Railroad Company will build twelve electric locomotives at its shops at Altoona, Pa., the electrical equipment for the first six units to be furnished by the General Electric Company, Westinghouse Electric & Manufacturing Company and the American Brown Boveri Company. It is estimated that close to 400 electric locomotives will be required by the road on the completion of its $40,000,000 electrification program. The Lackawanna Railroad is concentrating on new power substations for its northern New Jersey electrified system and will push required installations to early completion.

A Pennsylvania manufacturer is furnishing a 3,500-kw. turbo-generator unit for a municipal electric plant installation in North Carolina, as well as switchboard, circuit breakers and accessory equipment. A Missouri company will furnish engine units for a municipal power station in South Dakota, switchboards and affiliated equipment to be supplied by a New York maker. An Eastern manufacturer has a contract for ten heavy type transformers for a new central station in Missouri. The Graybar Electric Company will furnish equipment for an ornamental lighting system at Clintonville, Wis. A New York manufacturer has secured an award for arc lights for a northern New York power company, totaling $30,000.

CONSTRUCTION PROJECTS

Signal Supply Officer, Signal Corps, United States Army, Brooklyn, N. Y., will receive bids until September 9 for six 80-ft. steel radio towers (Circular 13); also, until September 16, for 200,000 ft. of wire (Circular 15), and at last noted time, for three storage batteries (Circular 14). American Can Company, New York, has approved plans for a plant at Seattle, Wash., to cost $1,000,000. Flexlume Corporation, Buffalo, N. Y., plans addition to electric sign manufacturing plant to cost $100,000. General Electric Company, Schenectady, N. Y., has filed plans for a factory branch and distributing plant at Cleveland, Ohio, to cost over $500,000. Buffalo General Electric Company, Buffalo, N. Y., has plans for two power substations to cost over $75,000. Continental Can Company, New York, has approved plans for immediate construction of can-manufacturing plant at Camden, N. J., to cost over $1,000,000. Public Service Electric & Gas Company, Newark, N. J., has taken title to property at Sewaren, N. J., and contemplates new power plant to cost over $5,000,000. South Branch Power Company, Philadelphia, Pa., plans hydro-electric power plant on branch of Potomac River in West Virginia to cost over $1,500,000. Pennsylvania Power & Light Company, Allentown, Pa., contemplates power plant near Sunbury, Pa., to cost over $15,000,000. General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until September 23 for insulated cable, wire, fuses, etc. (Panama Schedule 2586).

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SOUTHWEST

—WHILE MOST OF THE BUYING *during the past month has been by central stations and railways, during the past week there has been some activity among industrials. The movement of poles and other line material continues in fair volume.*

An order was placed by one of the local power companies for regulating apparatus amounting to $15,000. One of the lead mining companies bought a 600-hp. motor for pump connection to cost, with control, $5,000. Motors for operating two flour mills were ordered, the aggregate cost of all being about $4,500. One of the jobbing houses reports shipment of five carloads of poles for additions to transmission lines in southern Missouri.

CONSTRUCTION PROJECTS

St. Charles, Mo., has authorized plans for a municipal electric power plant. Kansas City Power & Light Company, Kansas City, Mo., has filed plans for a power substation to cost about $100,000. DeSoto, Mo., plans installation of a municipal light and power distributing system. Texas Mining & Smelting Co., Laredo, Tex., plans plant to cost over $250,000. Southwestern Public Service Company, Amarillo, Tex., plans extensions in power plant at Pampa, Tex., to cost over $150,000. Henrietta, Tex., plans municipal electric light and power plant to cost over $80,000.

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NEW ENGLAND

—DURING THE PAST WEEK *no orders for heavy equipment of outstanding interest were reported. Small power equipment, on the other hand, is moving fairly well and small motors are maintaining a steady level, though somewhat below last year.*

—PENDING DECISIONS RELATIVE *to fall production on the part of machine tool manufacturers, fractional-horsepower motors are at the present selling in small lots. Scheduled material sales have slackened somewhat and central station supplies are dull. Inquiries are being received, but negotiations are not being carried forward.*

Orders for wiring materials have increased recently, and in particular outside illumination products, the latter being considerably above the volume of last month. Electric furnace manufacturers report an interest in this type of equipment, but orders are few due to the postponement among machine tool manufacturers and the metal industries. Merchandising was less active during the past week. New construction projects are numerous in certain lines and wiring contracts are gaining in number. Intercommunication equipment and sound projection apparatus sales are encouraging. Contracts for the latter involving installations in public halls recently received amount to about $4,000, and a number of others are pending. Street-lighting and automatic traffic signal equipment are receiving some attention.

CONSTRUCTION PROJECTS

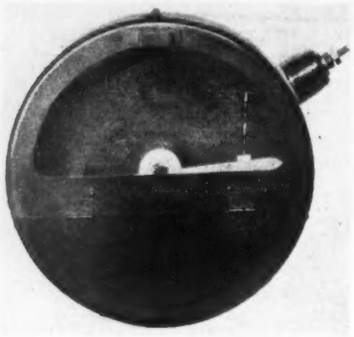
Boston Elevated Railway Company, Boston, Mass., has taken out a permit for a bus garage and service plant to cost over $150,000. Stamford Gas & Electric Company, Stamford, Conn., has approved plans for an equipment storage and distributing plant to cost $125,000. Yale University, New Haven, Conn., plans new buildings, including unit for Sheffield Scientific School, to cost over $5,000,000.

New Equipment Available

Surge Indicator Locates Flashovers

TRANSMISSION LINE PATROLMEN are accurately informed of flashovers that occur on high-voltage insulators as the result of lightning, or high voltage induced in the lines by other causes, by a surge indicator developed by the General Electric Company, Schenectady.

This instrument consists of an indi-



cating target actuated by spring pressure and a releasing link mounted in a 9-in. drum type case. The disrupting link operates on a very small amount of energy, and surges in the order of millionths of a second are detected. As soon as the surge occurs the indicating disk moves to the visible position.

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Automatic Starters for Two-Speed Motors

INCLOSED AUTOMATIC MOTOR STARTERS for two-speed separate winding type squirrel cage motors are announced by Cutler-Hammer, Inc., Milwaukee, Wis. These starters, to be known as Bulletin 9736, are the across-the-line type, the windings being connected directly to the line. Both windings are protected against dangerous overloads by means of C-H thermal overload relays. A push-button master switch with "stop," "low" and "high" buttons is used to obtain control from a remote point.

Starters can be furnished in three types—for starting on either winding, with sequence compelling feature or with automatic sequence control relay. For starting on either winding, depressing either the "low" or "high" button starts the motor on the respective "low" or "high" speed winding. The sequence compelling feature requires that the motor always be started at low speed before being transferred to high speed. Depressing the "high" button will not start the motor. The automatic sequence control relay insures that the motor will always start at low speed and pass to high speed automatically.

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SERVICE CONNECTORS which do away with soldering and eliminate the hazards of hot solder and blow torches are announced by the W. N. Matthews Corporation, St. Louis. There are only two pieces to this connector. The clamping member is made of rolled copper and it swivels within the nut so that it cannot come out. The connector makes possible the use of hard-drawn copper instead of soft drawn, which does away with the necessity of frequently pulling slack from the service wires.

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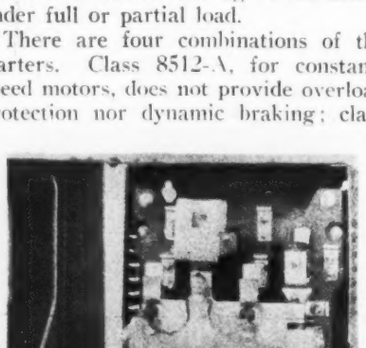
Remote-Controlled Magnetic Starters

REMOTE-CONTROLLED MAGNETIC STARTERS for constant and adjustable speed direct-current motors in sizes up to 10 hp., 230 volts are announced by Westinghouse Electric & Manufacturing Company, East Pittsburgh. These time starters provide three points of definite time-limit acceleration which permit safe and accurate starting of the motor under full or partial load.

There are four combinations of the starters. Class 8512-A, for constant-speed motors, does not provide overload protection nor dynamic braking; class

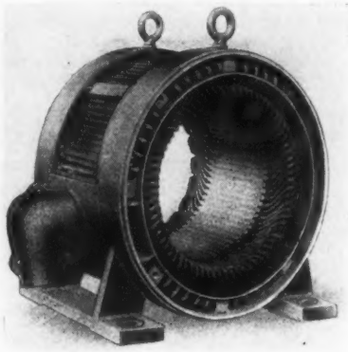


8512-B, for constant speed motors, provides thermal relay overload protection but not dynamic braking; class 8512-C, for constant-speed motors, provides overload protection and dynamic braking; class 8512-F, for adjustable speed motors, provides overload protection, dynamic braking and full field starting.

Inclosed, Fan-Cooled, Induction Motors

FULLY INCLOSED, FAN-COOLED, 1,200-r.p.m. induction motors in sizes of 20 hp. and above are announced by the Reliance Electric & Engineering Company, Cleveland.

These motors use the Mossay principle of cooling. A single internal fan



on the rotor circulates the confined warm air through the tubes over which blasts of cool outside air are blown from one end of the motor to the other.

The stator windings and rotor are tightly inclosed, the fits for all the inclosing parts being machined surfaces. In dismantling, the only extra parts to remove in addition to those of the standard open motor are the external fan guard and fan.

These motors have the same mounting dimensions as the standard open motors of the same horsepower and speed rating, which provides for interchangeability.

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Precision Time Switch for Electrical Apparatus

PRECISE AUTOMATIC CONTROL of motors, substations, floodlights, electric signs, ventilation, and the like, may be obtained by means of the Sangamo time switch announced by the Sangamo Electric Company, Springfield, Ill., according to its manufacturer.

This instrument is essentially an electrically wound Hamilton-Sangamo clock arranged to trip a mercury-tube switch. The dial is arranged to open or close the switch as often as every fifteen minutes, if desired, through a cycle of 24 hours.

The switch mechanism is operated by the mainspring through a differential gear, so that in case the motor is stopped due to current interruption the spring will trip the switch at the proper time.

The time switch is made for either a.c. or d.c. operation. It is independent of frequency or voltage regulations.